JANUARY

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

Hundred Years Study of Bone—*Ham*
Full Denture Construction—*Smith*
Treatment of Children's Teeth—*Honoroff*
Scientific Feeding of Children—*Roberts*
Fifteen Years of Research—*Souder*
Gold Inlays—*Scholten*
Tribal Skulls and Tooth Development—*Gans*
Porcelain Bridge Restorations—*Argue*
Local Anesthesia and the Child—*Hagan*
Periodontoclasia—*Kirkland*
Feeding in Prevention of Caries—*Kugelmass et al.*
Prognathism Correction by New Procedure—*Pettit and Walrath*
Review of the Year—*Thomas*
EDITORIALS
Ominous Prediction—Fee for Professional Advice—Root Canals and Their Therapy
COUNCIL ON DENTAL THERAPEUTICS
Accepted Dental Remedies
BUREAU OF PUBLIC RELATIONS
Care of Needy Children: Bronx Plan
Lay Dental Health Education—*Wandel*

AMERICAN DENTAL ASSOCIATION ORGANIZED 1859 INCORPORATED 1907

CONTENTS

H. E. Harvey, D.D.S. ..... Frontispiece

ORIGINAL COMMUNICATIONS

The Last Hundred Years in the Study of Bone.
By Arthur Ham, M.B. 3
Advancements in Full Denture Construction.
By Earle S. Smith, D.D.S., F.A.C.D. 12
Prevention Through Systematized Treatment of Children's Teeth.
By Henry A. Honoroff, D.D.S. 33
Scientific Feeding of Children.
By Lydia J. Roberts 41
Fifteen Years of Dental Research at the National Bureau of Standards.
By Wilmer Souder, Ph.D., F.A.C.D. 58
Gold Inlays.
By John Scholten, D.D.S., F.A.C.D. 66
The Dentist in Group Medicine.
By Boyd S. Gardner, D.D.S. 75
Investigation of Tribal Skulls with Significance to Tooth Development.
By Louis R. Gans, D.D.S. 83
Esthetic Value of Porcelain in Fixed Bridge Restorations.
By J. E. Argue, D.D.S. 90
Local Anesthesia as Applied to the Child.
By C. W. Hagan, D.D.S. 99
Surgical Treatment of Periodontoclasia.
By Olin Kirkland, D.D.S. 105
Raw Basic Feeding in the Prevention and Treatment of Dental Caries.
By I. Newton Kugelmass, M.D., Ph.D., Sc.D.; Thomas B. King, D.D.S., and Charles F. Bodecker, D.D.S., F.A.C.D. 110
Prognathism and Its Surgical Correction by a New Procedure.
By Joseph A. Pettit, M.D., F.A.C.S., and C. H. Walrath, D.M.D. 125
A Review of the Year.
By Newton G. Thomas, M.A., D.D.S. 129
Prescription Writing: What It Means to the Dentist.
By George C. Schicks, Ph.G. 135
The United States Pharmacopeia: What It Should Mean to the Dentist.
By George C. Schicks, Ph.G. 137

EDITORIAL DEPARTMENT

An Ominous Prediction. The Economic Equity of a Fee for Professional Advice. Root Canals and Their Therapy. A New Column. Systematize Your Work. Back Journals and Reinstated Members. 140-148

COUNCIL ON DENTAL THERAPEUTICS

Accepted Dental Remedies 149

BUREAU OF PUBLIC RELATIONS

Dental Care of Needy Children: The Bronx Plan 163
The Bureau of Public Relations Offers "A Survey of Dental Diagnosis During Childhood."
By F. Blaine Rhobotham, D.D.S., F.A.C.D. 169
Lay Dental Health Education.
By George H. Wandel, D.D.S. 170
Make Use of Your Slide Service 180

NEWS

State, General and Foreign News 181

CURRENT LITERATURE

Abstracts 185

MISCELLANY

Books Received 188
Correspondence 188
Resolutions of the American Society of Orthodontists on Publicity 188
Letter to the Executive Officers of the State Dental Societies and Others 189

Announcements 191

ADVERTISEMENTS

Index to Advertisements A-24
Classified Section A-31

The Journal of the American Dental Association, Vol. XXI, No. 1. Published by the American Dental Association, 212 East Superior Street, Chicago, Ill. Yearly subscription, $3.50. Entered as second-class matter, May 1, 1928, at the postoffice at Chicago, Ill., under the act of Aug. 24, 1912. Published monthly.
Copyright, 1934, by the American Dental Association.

H. E. HARVEY, D.D.S., Washington, D. C.
Vice President of the American Dental Association

UNIV. OF MICH.

THE JOURNAL
of the AMERICAN DENTAL ASSOCIATION

Vol. 21 JANUARY, 1934 No. 1

Original Communications

THE LAST HUNDRED YEARS IN THE STUDY OF BONE*

By ARTHUR HAM, M.B., Toronto, Canada

TO begin this paper with a discussion of the vital staining of bone would give one the impression that it was a presentation of some modern piece of research, but our discussion of the problem may well start with the work of Belchier, who, nearly 200 years ago, noticed one evening, when he was a guest at dinner, that the bone in the center of the roast was red, and, on inquiry, found that his host had utilized madder, a dye substance, in the feeding of his stock.

Belchier employed this method as an experimental procedure, and found that madder, which we now know contains alizarin, would, if it comprised a part of the diet, color the bones of an animal. He reported this work, which shortly came to the notice of Duhamel. The latter utilized this procedure of vital staining with more skill, and found that madder only stained the bone which formed while the dye substance was being fed.

Duhamel, a little less than 200 years ago, did really remarkable work to advance the knowledge of bone. He studied the repair of bone in detail and found that the periosteum became swollen after a fracture and that the internal periosteum or endosteum also became swollen and participated in the process of repair. He thus proposed the theory concerning the osteogenic power of the periosteum, and, after further studies with madder, concluded that bone grew in width by the additions of layers of bone formed from the periosteum. He cut notches in bones and found that the notches cut in the shaft of a growing long bone did not become farther apart as growth ensued, but when he cut notches in both the shaft and the extremities, he found that they did become separated, and he therefore concluded that the longitudinal growth

*From the Department of Anatomy, University of Toronto.

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 9, 1933.

of bone occurred at a zone near its extremities. It is thus evident that Duhamel knew a great deal about bone, and that his knowledge, nearly 200 years ago, obtained without the use of the microscope, was much sounder than that possessed by many relatively modern authors.

One would think that the knowledge of bone, with such a beginning, would have advanced rapidly. We now find another attribute of bone beginning to make its appearance, namely, its ability to incite controversy. Duhamel's work was by no means universally accepted, and it was not very long before Haller, having observed the close relationship between arteries and bone formation, came to the conclusion that bone was formed by arteries and that the virtue of periosteum was that it contained these blood vessels. Thus, in the middle of the eighteenth century, the two opposing schools of thought concerning bone growth and regeneration had arisen, the school of Duhamel, which insisted that periosteum was the mother tissue of bone, and the school of Haller, which believed that periosteum has no osteogenic virtue whatever. Any one who reviews the twentieth century literature will readily see that this controversy, to some degree, still exists.

Haller was followed by Hunter, who observed that detached fragments of bone sometimes appeared to live. He used vital staining to find that the phenomenon of growth entailed two distinct processes, one of building and one of resorption. He concluded that living bone was constantly changing its substance matter and that, while bone was being destroyed at one place, it was being added to in another, and thus its strength was not impaired. Hunter appeared to have appreciated to a high degree the physiologic aspect of this tissue. Regarding regeneration, he was not so original, being a follower of Haller, who believed that bone was laid down by arteries. Hunter also thought that the lymphatics were responsible for its resorption.

Some years later, the Scotch surgeon Syme performed more experiments in an attempt to settle the question as to whether the periosteum was osteogenic. He excised pieces of bone and found that if he left periosteum, regeneration occurred in the defect, but if he excised the periosteum with the bone, no regeneration occurred. The experiments appeared to Syme to be convincing evidence in support of Duhamel's theory.

The introduction of the microscope now began to have its effect on the study of bone. Goodsir, who followed Syme, found cartilage cells arranged in rows at the epiphyseal plate and thought that these same cells later became bone corpuscles or bone cells. He was impressed with the cells of bone, and believed these corpuscles to be essential for regeneration processes. He performed experiments which indicated to him that periosteum had no osteogenic function and explained the results of the Duhamelites by suggesting that bone adhered to the periosteum they worked with.

While Goodsir was in Scotland emphasizing the importance of the bone cells in both the formation and the destruction of bone, Flourens, in France, was completing work which he thought supported Duhamel's contentions regarding periosteum. Flourens' work furthermore supported Hunter's ideas about the substance of bone always being in a state of flux, and he made further observations on the part that the epiphyseal plate area played in the longitudinal growth of bone.

Ollier next took up the cudgels for the

cause of the periosteum, and, sensitive to Goodsir's criticism of former experiments, he carefully inspected all his periosteal transplants with the microscope in order to demonstrate that no bone particles adhered to them. He found that these bone-free transplants of periosteum still possessed the ability to produce bone. Ollier furthermore made some striking observations which gave the clue to an understanding of the process of differentiation of the osteogenic cell. He found that the deep cells of the periosteum reacted to irritation by proliferation, and that after they had proliferated, the ones adjacent to the original bone were gradually transformed into young bone cells, a gradual transition between periosteal cells and bone cells being found in the repair tissue. Ollier also did a considerable amount of work in the field of bone transplantation, and he found that transplants complete with their periosteum survived and grew; whereas, those without their periosteum or endosteal covering died and acted as foreign bodies.

The scene now shifts to Glasgow, Scotland, in the year 1880, where Macewen was beginning to have remarkable success with the use of bone grafts in clinical surgery. He was greatly impressed with the apparent viability of bone grafts and consequently did not think very highly of the osteogenic virtue of the periosteum, concluding that its usefulness was largely in being a limiting membrane. Macewen did not base his conclusions solely on clinical work, but performed an immense number of experiments which seemed to establish the ability of bone minus periosteum to live and flourish. One obtains the impression from many of Macewen's experiments that he used a rather insecure method in drawing his conclusions. He often proved to his satisfaction that periosteum possessed no osteogenic virtue, and then concluded that regeneration must come from bone.

Sir Arthur Keith, in his most comprehensive and entertaining book, "The Menders of the Maimed," traced the story of this periosteum *versus* bone controversy with great skill, and, after reaching Macewen's work, said that, at first sight, it looked as if the dogs of Edinburgh and Lyons were provided with a different kind of periosteum from that which clothed the bones of dogs in Glasgow. It seems remarkable that such diametrically opposed conclusions should have been reached by so many different investigators, and it is amazing that this controversy should still exist to some degree at least.

The work of the last few decades performed by Axhausen, Barth, Albee, Gallie and Robertson, Phemister, Mayer and Wehner, McWilliams, Rhode, Ely, Smith, Berg and Thalhimer and others offers an immense amount of material for study. The conclusions drawn by some of these authors tend to support one side or the other of the periosteum *versus* bone controversy, and with the development of a better understanding of the constituent cells in bone, this point is gradually disappearing as an issue. It is becoming apparent that there never should have been an argument about the relative virtues of periosteum and bone as regards regeneration, because each tissue is composed of two types of cells which have entirely different sorts of potentialities. The first point which has been definitely established is that the adult bone cells which lie in lacunae and which are surrounded by matrix do not give histologic evidence of proliferative ability. This is to be expected, as they are highly differentiated elements, and even the

most violent supporters of the school which argued against the ability of periosteum to produce bone have been unable to prove histologically that the adult bone cells are able to regenerate. One might then question the results of those who have obtained evidence of regeneration from fragments of bone stripped of their periosteum, and the answer to this problem is that bone tissue is lined on the sides of all its haversian canals and its interior by osteogenic cells which are identical with those found in the deep layer of the periosteum. Thus, it is evident that bone tissue, stripped of its periosteum, could reproduce more bone tissue by virtue of the osteogenic cells, which line not only the narrow cavity but also the haversian canals.

One might next ask the reason for all the conflicting experiments regarding the ability of periosteum to reproduce bone. The answer to this problem, which is also quite simple, is found in the fact that periosteum is composed of two separate layers. The outer coat is composed of fibroblasts and collagenous and elastic fibers, while the inner coat is composed of osteogenic cells which are specially adapted to forming bone. There is a peculiar thing about periosteum which has caused all the confusion, and that is the fact that, when it is stripped, it is apt to split and the osteogenic layer is prone to adhere to the bone. Consequently, if experiments are performed on the part which has been stripped, the chances are that the experiment will be performed with nothing but fibrous tissue, and therefore bone regeneration will in all likelihood not appear. If one is careful, in the experiment, to remove the osteogenic cells of the periosteum from the bone along with the fibrous layer, transplants of periosteum will produce bone with ease.

Thus, the modern conception of the cells of bone is that the adult bone cells are end products and that repair and regeneration of this tissue may readily be accomplished by the osteogenic cells, which are the mother or generative cells of bone, and which exist in the deep layer of the periosteum and make up the endosteum lining the marrow cavity and the haversian canals.

It is to be noted that we have called these osteogenic cells rather than osteoblasts, and this has been done for a particular reason. It has been common knowledge for a long time that cartilage often appeared during the repair of a fracture. Adami discussed the problem and considered the condition due to metaplasia. On the other hand, we must remember that, in the development of endochondral bone, osteogenic cells, the descendents of which later give rise to bone cells, first produce cartilage. Furthermore, we know that if malignant tumors arise in bone, they are very apt to produce cartilage. Thus, it would seem that these cells which line bone might be termed either chondroblasts or osteoblasts, but it seems better to call them neither, because they all seem to have the ability to produce cartilage as well as bone in development and in repair, and also in tumors. We might ask why these cells should, on some occasions, produce cartilage and, on other occasions, bone; and for the answer we might well examine a finding of Hallers which was confirmed by Hunter; namely, that bone was always found in close association with blood vessels. They thought that bone was formed by the arteries, but the most recent suggestion on this problem is that the osteogenic cell, in the presence of an excellent blood supply, tends to differentiate into an osteoblast, which is really a young bone cell; and then, as time goes on, into an adult bone cell. On

the other hand, if an osteogenic cell differentiates in the absence of a blood supply, it is likely to differentiate along the cartilage pathway. Indications for this belief may be had from the examination of developing bone and also from a study of the repair of fractures.

Before leaving the problem of the cells of bone, we should comment on a phenomenon which is apt to be confusing to those who are firmly grounded in the theories of cell specificity. It has been known for a long time that bone is occasionally found in areas far removed from the normal sites of bone in the body. These findings were first explained by postulating that cells from bone had migrated to these distant locations. In 1900, metaplastic bone was produced experimentally in the kidney by two Italian workers by the relatively simple procedure of tying off the renal artery on one side in experimental animals. The kidney on the affected side showed some necrosis and calcification, and it was near areas of calcification that ossification later appeared. Routine pathologic studies have demonstrated that the occurrence of metaplastic bone is by no means unusual in such tissues as arteries, tonsil or abdominal scars. It has been shown furthermore that these areas of metaplastic bone formation usually occur near a calcium deposit. Thus, one is forced to the conclusion that there are cells scattered about in the body which possess the potentiality of bone formation. Since the work of Maximow, who has so clearly demonstrated the existence of undifferentiated mesenchymal cells throughout the soft tissues, these results are much easier to interpret, but there have been some observers who, it appears, have been so impressed with the occurrence of metaplastic bone formation that the regenerative ability of periosteum has once more had to withstand an attack at their hands. Leriche and Policard think the most important factor in bone regeneration is the calcium surcharge, and whereas the occurrence of metaplastic bone near calcium deposits suggests that calcium has the ability to promote the differentiation of cells along the osteogenic pathway, it does nothing to change the present-day opinion regarding the importance of the osteogenic cells of periosteum and endosteum as the prime factor in the normal repair of bone.

Before leaving this problem of metaplastic bone formation, the work of Huggins should be mentioned, as he found that transplantation of bladder mucosa into certain tissues would result in bone formation. Other workers have since failed to produce an extract from bladder mucosa which would produce the same effect, although they have confirmed his results. Thus, although we know certain facts about metaplastic bone formation, it is evident that, in all probability, we are only beginning to learn of the various factors in its production.

Having thus traced briefly the story of the development of knowledge of the cells of bone, we are now prepared to investigate the various opinions which have been held throughout the last hundred years regarding the other constituent of bone, namely, the matrix. The older ideas about bone did not, of course, differentiate very clearly between cells and matrix, and the tissue was thought of as resulting from the solidification of an effusion. With the development of the use of the microscope, the part that cells played in its structure began to be appreciated, and Goodsir, a little less than 100 years ago, evidenced a remarkable insight into the problem by studying not only the structure of bone but also the

structure of sponges and finding in them the sponge cells.

As research continued on this problem, it gradually became recognized that bone was not unlike ordinary fibrous tissue, as it was composed of cells and a matrix containing fibers which were very much like the collagenous fibers of the latter. There is one striking difference between the two tissues and that is the presence of a great mineral content, which is held in the matrix of bone tissue. This mineral content, which is chiefly the phosphate and carbonate of calcium, appears to be held by a ground substance, and it was the usual opinion, up to the last two decades, that this mineral content of the matrix was deposited in or secreted into the matrix by the bone cells. Thus, the usual theory of bone formation and resorption was developed which postulated that the osteoblasts deposited the calcium salts into the matrix and the osteoclasts removed the calcium salts from the matrix when resorption occurred.

The last twenty-five years has provided much material to seriously question this almost universally accepted and fundamental belief about bone. It was found, for instance, that pathologic areas of calcification which formed in the body, and which were obviously not formed by the secretory activity of cells, contained almost exactly the same percentages of mineral salts as the matrix of bone and cartilage. These pathologic areas of calcification have been explained various ways, but most of them were supposed to have developed because of the tissues developing either a chemical or a physicochemical affinity for calcium salts. The suggestion then began to come to mind that bone matrix might become calcified in the same sort of way, and that the calcium salts of bone were not deposited by specific secretory activity on the part of the cells. In this connection, Wells performed an interesting experiment when he transplanted some boiled cartilage in the body, and found that, although it contained no live cells, it still managed to take up in its matrix a considerable amount of calcium salts.

The use of tissue culture methods added considerably to the possibility of critical experiments in this field, and, in 1926, Shipley, Kramer and Howland made some very interesting observations when they placed the epiphyseal cartilages of rachitic animals in solutions containing available mineral salts and found that the cartilage soon became well calcified. They found that if the cartilage cells were first killed by treating the cartilage with heat or protoplasmic poisons, the proper sort of calcification did not follow. These experiments showed that cells were necessary for the deposition of calcium, and one might be almost justified in assuming from them that the cells were responsible for the secretion of calcium salts into the matrix. It was soon to become obvious that the part the cells played was not a direct one; that is, a[illegible] tual secreting of calcium salts, but an i[illegible] direct one. To illustrate this point, some experiments of Robison and his coworkers should be quoted. They found that osteoblasts, or young bone cells, as well as adult cartilage cells, manufactured an enzyme which possesses the ability to hydrolyze phosphoric esters and liberate free phosphate ions. They found that slices of bone which were killed would not calcify perfectly, but if some of this enzyme, phosphatase, was added to the solution, the matrix of the bone calcified perfectly even if the cells were all dead. Thus, the part that the cells of bone play in the calcification process is, it would seem, not in secreting the calcium salts into the matrix but in producing (1) a

matrix having a ground substance which has a profound affinity for calcium salts, and (2) an enzyme which causes a local increase in the number of free phosphate ions in the vicinity of the cell; which enhances precipitation phenomena.

As it is then apparent that the matrix of bone acts as a sort of recipient of calcium salts when they are in solution in the adjacent tissue fluids, and that the bone cells elaborate an enzyme which encourages the precipitation of phosphates in their vicinity, we are now able to approach the next part of the calcification problem, which concerns the ways and means by which these salts of calcium are able to reach the matrix. Most of our knowledge in this field has been gained in the last part of the hundred years era which falls within the scope of this paper, and, at the moment, this problem is receiving a tremendous amount of study and investigation.

The first observation which gives a clue to the complexities which should be expected in this realm of research is the fact that the blood contains far more calcium than can be accounted for by the laws of simple solution. Different explanations of this phenomenon have been offered and, to sum up some of the results of experimentation, it now seems that the total calcium of the serum must be divided into several different fractions. Obviously, one of these fractions must be the calcium which is in simple solution, and this fraction amounts to only a small part of the total amount present in the blood. The importance of this small fraction must not be minimized, because it is obvious that it possesses the ability to ionize and thus allow the physiologic activities of the resulting ions to become apparent.

Before considering the next fraction of the calcium of the blood, we should refer to the work of Collip, who prepared an extract of the parathyroid glands which possessed the ability to control the level of the serum calcium. It had been known for many years before this time that the removal of the parathyroid glands of an animal would result in a condition known as tetany, and it has also been known that this condition was associated with a low level of the serum calcium. Collip was able with his extract to cure the tetany of parathyroidectomized dogs.

The problem concerning the action of this hormone which controls the level of the serum calcium is as yet not solved. There are three theories which are at the moment under consideration:

1. That the parathyroid hormone controls the formation of a compound of calcium with itself, the compound existing in the serum.

2. That the parathyroid hormone controls the formation of some unknown compound of calcium in the serum.

3. That the parathyroid hormone so stimulates the process of resorption in bones that calcium is liberated from the bones to the blood.

The evidence supporting or denying these different hypotheses concerning parathyroid hormone action is much too extensive to consider in detail in this paper. Consequently, I might be excused for stating that evidence of the ability of the parathyroid hormone to control a fraction of the serum calcium appears to me to be much more convincing than the evidence that the action of the parathyroid hormone is exerted on the bones.

To date, we have, therefore, postulated the presence of two separate fractions of calcium in the serum, one which is in simple solution and one which is controlled by the parathyroid hormone. There is also definite evidence of the presence of a third fraction which is associated with serum proteins, but, for our

purpose, we may content ourselves by dealing with the first two fractions.

There is evidence that a sort of equilibrium exists between the calcium of the parathyroid-controlled fraction of the serum, the fraction of the serum calcium which is in simple solution and the calcium which resides in the matrix of the skeleton. The equilibrium is probably more comprehensive than this and may be most easily visualized if one considers the fraction of the serum calcium which is in simple solution to be in equilibrium, not only with the fraction of the serum calcium controlled by the parathyroid hormone, but also with all the tissues of the body, including the matrix of bone and the epithelial cells of the gastro-intestinal tract.

To apply this conception of the calcium equilibrium, we could then imagine the course of events if a growing animal had its parathyroid glands removed. The parthyroid-controlled fraction of serum would fall, and this fall would in turn so lower the fraction of calcium in simple solution that there would be only a very small amount of calcium near the bones for precipitation into matrix. Thus, the matrix that formed would be imperfectly calcified and the final result would be the production of a great deal of poorly calcified osteoid tissue in the growing zones of bone, and this condition is nothing else than a simple type of rickets. Naturally, this is not the usual way in which rickets is produced and while we are on this particular phase of the topic, it should be noted that rickets may also be produced by the same sort of mechanism by depriving the animal in its diet of the normal mineral constituents which are necessary for the calcification of bone.

We can now appreciate the effect of large continuous injections of parathyroid hormone into an animal or the situation which develops when an individual develops a tumor of the parathyroid gland. When an increased amount of this hormone is present in the circulation, it causes the formation of a greatly increased amount of the fraction of serum calcium associated with the parathyroid hormone. The calcium which is thus tied up in the blood by the hormone must be obtained from the gut and the bones, and thus the bones are depleted of calcium, while the total calcium of the blood increases in amount. In other words, because of the equilibrium, the parathyroid-controlled fraction of the serum draws calcium from the bones, but as soon as the serum calcium level is raised sufficiently, calcium flows over into the urine and the calcium of the bones is thus gradually withdrawn and passed over into the urine. In this condition, the cells of the bones once more react by proliferating. In the attempt to repair the disintegration, many of them differentiate into foreign body giant cells or osteoclasts, while others form a tissue more like fibrous tissue than bone. The condition is known as osteitis fibrosa cystica, and it is now known that many of the generalized bone diseases in this category represent nothing more than attempts on the part of the cells of bone to compensate for the loss of calcium caused by the abnormal amount of parathyroid hormone in the circulation.

We are now in a position to consider another agent which has been shown in the last part of the hundred year era to have a profound influence on bone growth. This agent, known as vitamin D, was found to be a remarkable prophylactic agent in the prevention of rickets. It is often considered by those unfamiliar with the complexities of calcium metabolism to be an agent which acts by im-

proving the calcification of bone. It is very improbable that vitamin D has any direct action on bone. It has a profound effect on the calcium metabolism. The manner of its action is, as yet, somewhat obscure. There are many observers who consider it to act by simply increasing the absorption or ionization of calcium, and I have pointed out on several occasions that these theories do not explain its ability, when administered in tremendous doses, to cause a depletion of the bony reservoirs. It has been observed by numerous investigators that the administration of tremendous doses of this agent will cause calcification in many soft parts of the body and, at the same time, a depletion of the calcium of the bones. Thus, the vitamin which in therapeutic doses appears to aid the process of calcification will, in tremendous doses, interfere with the same process and yet institute calcification in the soft tissues. It should be clearly understood that these undesirable effects are produced only with dosages which are enormously beyond any commonly employed in therapeutic procedure.

Taylor and his co-workers have offered a great deal of evidence that vitamin D acts through the parathyroid mechanism. They show that the effect of vitamin D and the parathyroid hormone is, in almost all respects, very similar, and that vitamin D does not exert its usual effect in animals from which the parathyroid glands have been removed by exceedingly careful dissection. There is a great deal of controversial evidence on this point, as it is very difficult to remove all the parathyroid tissue from an animal; but the case for the theory that vitamin D acts through the parathyroid mechanism appears to be growing consistently stronger.

The paradoxical effects of vitamin D action have been explained by me in conjunction with Schour by the suggestion that, after the administration of a single enormous dose of either vitamin D or parathyroid hormone, a shift in calcium occurs from the bones to the blood, and then when the parathyroid-controlled fraction of the serum is no longer able to retain all this extra calcium that it has taken on, a shift in calcium occurs toward the tissues; but that, in the course of the latter process, so much calcium may be liberated that the blood is unable to retain it in simple solution, it being precipitated in the tissues. Thus, the process of normal calcification was found to be interfered with during the period of rise in the serum calcium level following a single enormous dose of either substance, and then later, when the serum calcium level began to fall, not only was the process of normal calcification improved, but pathologic calcifications appeared as well.

It is thus seen that the mechanism by which the normal amount of calcium salts is made available for the matrix of bone is very complex. It is furthermore evident that the calcium of the matrix is in a sort of equilibrium with the rest of the calcium of the body and that this equilibrium may be affected by many agents. Thus, the structure of bone may be profoundly affected by any condition which affects any one of these many factors. All this work brings us farther from the conception that the deposition and removal of calcium in bone is the direct effect of cellular activity. The evidence at hand does not suggest that the osteoblast secretes calcium into bone, and this conception has been for the most part discarded. On the other hand, most people are loath to give up the idea which considers the osteoclast to be the specific resorber of bone. As the calcium of the

matrix of bone is in an equilibrium with the calcium of the blood, it does not seem necessary to postulate the need for any specific cell to remove calcium, which seems to shift back and forth between bones and blood by virtue of the existing equilibrium. On the other hand, there is no doubt of the fact that osteoclasts are usually present where resorption is occurring. It is suggested that they are the result of the differentiation of osteogenic cells in an area or environment where bone is disintegrating. After they have formed, they may assist in the further breaking down of tissue, but originally they seem to be the result of breaking down of bone rather than its immediate cause.

Thus, we see that although the cells of bone are not directly concerned in altering the calcium content of the matrix, they are indirectly affected to a great extent by disturbances of its matrix. Furthermore, the cells of bone are sensitive to many other conditions than the state of calcification of the matrix. Sir Arthur Keith, after discussing Wolff's work on bone, and Goodsir's, Woodland's and Dendy's work on sponges, said that "osteoblasts seem to conduct the work of bone building as if they had been given the training of expert and unerring engineers." Therefore, although the research on bone in the last hundred years has brought to light much information on the genetic relationship of the cells of bone, together with the part that bone plays as a calcium reservoir, we are still in the dark concerning the as yet mysterious environmental conditions that affect the proliferation and differentiation of osteogenic cells to make them change in size, shape and alinement of trabeculae, and, in general, act in a fashion which could be more easily explained if we could visualize the cells as possessing no small degree of intelligence.

ADVANCEMENTS IN FULL DENTURE CONSTRUCTION*

By EARLE S. SMITH, D.D.S., F.A.C.D., Iowa City, Iowa

MAY I ask you to sit back, relax, and forget that you live in the present age. Let your imagination run rife. Abolish from your mind all knowledge of late methods and materials and try to look at things of the present day through the eyes of an old, white-haired man, stooped and partially supporting himself with a cane, who trudged into my office one morning this spring. His face was furrowed with age; his eyebrows and hair were long and shaggy. The clothes he wore were neat but old fashioned. He had come from the land of long ago.

The usual greetings exchanged, I asked what service I could render. "Oh, none whatever," he replied. "I have just returned from the long distant past, a time when I, too, practiced this noble profession. I would so like to know what has happened in dentistry during the time I have been away, and especially

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 7, 1933.

Jour. A.D.A., January, 1934

along the line of full denture construction."

"It was just one hundred years ago that I began work with one of the well-known dentists of that day. This man, for some reason, had taken a liking to me and had invited me to work as his apprentice. I deemed myself fortunate. I

Fig. 1.—Impression tray, 1844. (Goddard.)

Fig. 2.—Impression made with elastic material.

had fancied that I would like to study dentistry but little expected to have an opportunity. There were no dental schools—the Baltimore School of Dental Surgery was not established until 1838—and the tuition fees charged by most dentists who taught apprentices were higher than I could afford. 'The advantage of a certificate of pupilship from one of these highly reputed dentists was so great that very large fees were paid for such tuition, imperfect as it was. Five hundred dollars was commonly asked—and of course very few could avail themselves of such dearly purchased privileges.'[2] I was indeed happy for the opportunity offered me.

"I worked hard, applied myself and read what few dental books I could get. There were not many books to be had, and it was not until 1839, when the *American Journal and a Dental Library*

Fig. 3.—E. J. Dunning. (Thorpe.)

of Dental Science was established, that we had much opportunity to learn what other men were doing. As one writer later expressed it, the establishment of the journal and library 'was the rising star of improvement, and was soon followed by more palpable evidences of the approach of daylight to the scattered members of the profession, who had long toiled in comparative obscurity, almost

1. A. J. D. S., 2nd Series, Vol. II, p. 98.
2. Harris, C. A.: Principles and Practice of Dental Surgery, Ed. 3, Philadelphia: Lindsay & Blakiston, 1848, p. 37.

unknown to each other and to the world.' "[2]

Just at this moment, my patient, for whom I was to construct a set of dentures, arrived. Gaining the permission of the patient, I invited the old man to take a seat where he could have an unobstructed view of the work as it was carried on.

The impression trays (Fig. 1) selected for the case caused little surprise. But immediately I began to knead and manipulate the modeling compound, the old gentleman became interested. Plaster and wax were the only materials available in his time for taking an impression. Naturally he thought I was using some new kind of wax.

"Although similar in many respects," I explained, "compound is not a wax. Compound is a composite material made of gum resin, stearin, chalk and several other ingredients. The method of manipulating compound when taking an impression is very much like the method employed in using wax. Both materials are hard when cold, but can be softened by heat and, in the plastic state, will give a distinct imprint of surfaces against which they are pressed. Modeling compound has some distinct advantages—it becomes harder, is not so easily distorted and can be heated to a larger range of plasticity. While sealing wax was used for certain phases of denture work as early as 1848, a compound suitable for impression work, as far as I have been able to find, was not originated until the 1880's.

"Recently, experimentation to produce an elastic material (Fig. 2) capable of being adapted to undercut areas, of yielding when being withdrawn from these areas by becoming momentarily deformed, to spring back and assume the shape formed when the impression was in place, has resulted in several materials of this type being offered to the profession. While these materials are more adaptable to partial denture work, they are used to some extent in the full denture field."

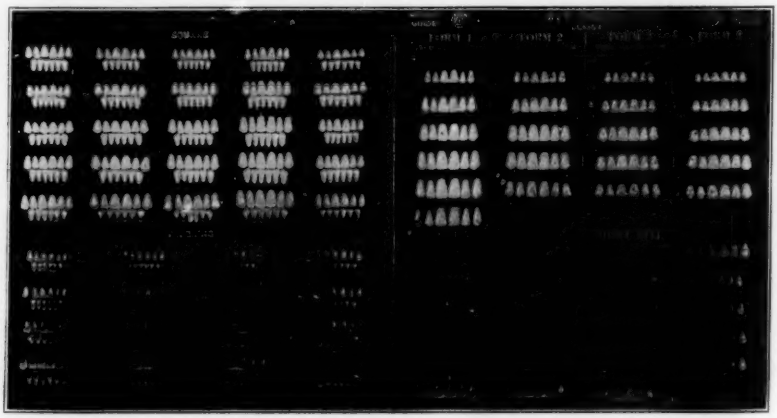

Fig. 4.—Modern mold guides.

"I can readily see," spoke up the old gentleman, "that modeling compound

and the elastic materials are a distinct advancement. Impression work can be accomplished more easily, with greater precision, and certain goals can be reached which were formerly impossible.

"In my apprentice days and for some time afterwards, wax was the only material used for impressions. We used plaster of Paris for casts, but we did not realize for a long time that it could be used for impressions.

"In March, 1844, a Dr. E. J. Dunning, of Syracuse, N. Y., was having difficulty with a case. He was using wax

Fig. 5.—J. Leon Williams. (Clapp.)

for the impression work, but, owing to an area of flabby tissue in the mouth in which he was working, was unable to get an impression without causing a marked distortion of this flabby tissue. After pondering on the problem for some time, he decided to try plaster of Paris. The result was highly satisfactory and to Dr. Dunning was given the credit for originating the use of plaster for impressions."[3]

3. Footnote 2, p. 642. Wescott, A: Use of Plaster of Paris for Taking Impressions of Mouth, D. Cosmos, 12:169 (April) 1870.

The impressions having been completed and my patient dismissed, our conversation naturally turned to the material that would be used for the casts. We went to the laboratory and I proceeded to put a boxing around each of the impressions and to pour them with a stone plaster.

"Even in our day, we boxed many of our impressions," remarked the old gentleman. "We took a strip of waxed muslin, about an inch and a half wide, wrapped it around an impression several times and then jarred in plaster of Paris by rapping the table with a hammer.[4]

"Although boxing an impression

Fig. 6.—Skulls showing similarity between shape of anterior teeth and shape of skull. (Dentists' Supply Company.)

isn't new to me, this stone plaster is a surprise. We realized that plaster had a low crushing strength, that it could be distorted and crumbled by pressure and men were continually trying to find some method of hardening. All in all, we were not very successful. While I am not surprised that the problem has been solved, I am amazed that a cast of stone-like hardness can be made in twenty or thirty minutes and with so little trouble."

"The experimentation to produce a stone plaster," I explained to him, "went

4. Goddard, P. B.: Anatomy, Physiology and Pathology of the Human Teeth, Philadelphia: Carey and Hart, 1844.

on for many years. In 1853, M. Sorel, a Frenchman, discovered that, by combining magnesium oxide and magnesium chloride, a hard, stonelike material could be produced.[5] Very little use was made of this combination, and nearly sixty years passed before a fairly good stone plaster was produced, and as accurately as I have been able to determine, Dr. Stewart J. Spence, of Chattanooga, Tenn., was the originator. It had many of the essential qualities, but it required from ten to twelve hours to set. Within the last few years, modern science has conquered this latter problem. The profession now has a gypsum material that sets rapidly, has a high crushing strength,

"This classification of teeth into square, tapering and ovoid forms," I explained, "is based on a theory that faces may be classified into these three forms, or their modifications, and that to create the most pleasing esthetic effects, harmony should exist between the shape of the anterior teeth and the shape of the face. This theory was formulated in 1914 by Dr. J. Leon Williams (Fig. 5), American born and American trained, but who was then practicing dentistry in London.

"The development of this theory came about in a most interesting way. Like many other discoveries, it was accidental.

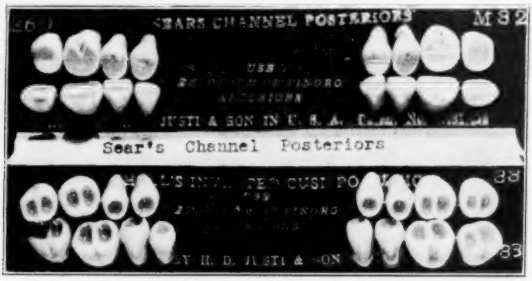

Fig. 7.—Tooth models showing recent ideas as to form of posterior teeth.

undergoes little change as regards expansion and contraction and produces a stonelike cast."

The mold guides (Fig. 4) lying on a nearby table arrested the attention of my visitor. He opened them and began to examine the teeth. "What beautiful and realistic forms!" he exclaimed. "Can it be possible that teeth may be obtained in so many different forms and sizes and in this wide variety of shades? And what is the significance of these terms: square, tapering and ovoid?"

"In the early part of the present century, this Dr. Williams felt the need of more natural forms of porcelain teeth for dental work and began to voice his disapproval of the forms of the teeth that were then available. He tried to interest other men in a movement to bring about an improvement, but, while a few men were interested, the profession as a whole was apathetic. Prosthetic dentistry was in the doldrums.

"Interest in operative dentistry had been on the increase and had wooed the profession away from its first love. A perusal of the Transactions of the American Dental Association for the years be-

5. Prothero, J. H.: Prosthetic Dentistry, Ed. 4, Chicago: Medico-Dental Publishing Company, 1928, p. 520.

tween 1850 and 1900 will substantiate this statement. One finds many papers on operative procedures, but only an occasional one on prosthesis. In 1872, the report of the committee on mechanical dentistry to the Association was in part as follows: 'While the operative branch of our profession has been advanced within the last few years, artificial dentistry, with few exceptions, has retrograded. The present status of this department is far below what it was

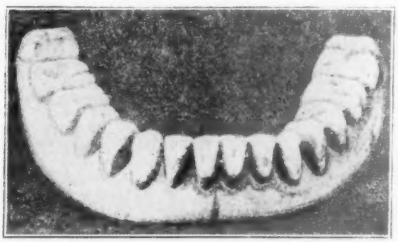

Fig. 8.—Hippopotamus ivory posterior teeth, human anterior teeth, seventeenth century. (Prothero.)

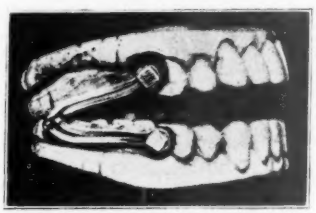

Fig. 9.—Carved ivory teeth. "Grasshopper springs" assist in retention. (Prothero.)

twenty-five or thirty years ago. We recommend that this branch receive more attention from the better class of dentists who can, if they will, check this backward movement.'[6]

"Again, in 1874, a hope was expressed that 'as advancement in operative and surgical dentistry has ceased for the time being, those men who have used their talents in that direction will look about for the means to elevate mechanical dentistry.'[7] In 1882 and in 1887, one again finds pessimistic allusions to the status of this department of dentistry.

"This marked trend of indifference and lack of interest became acute. In remarks before the New York Odontological Society in 1906, Dr. N. W. Kingsley stated: 'There has been a movement in certain parts of this coun-

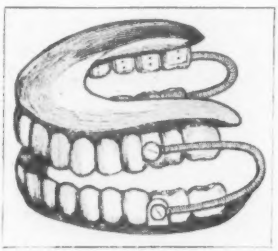

Fig. 10.—Old forms of teeth. Spiral springs assist in retention. (Harris.)

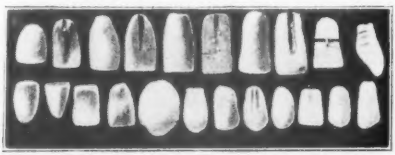

Fig. 11.—Early specimens of mineral teeth. (Taylor.)

try to divorce the two branches of dentistry from each other—to relegate everything that belongs to artificial dentistry to the carpenters and blacksmiths.'[8]

"With this condition prevailing, it was hard for Dr. Williams to arouse the interest of the profession, but without the endorsement of the profession and

6. Tr. A. D. A., 1872, p. 166.

7. Tr. A. D. A, 1874, p. 188.

8. Clapp, G. W.: Life and Work of James Leon Williams, New York: Dental Digest Publishing Co., 1925, p. 142.

with the largest users of teeth—the laboratories and the advertisers—satisfied with the forms being furnished, it was doubly hard to persuade the manufacturers that a radical change was advisable.

"Still Dr. Williams persevered, and finally was rewarded by having his idea endorsed by several of the smaller dental groups and in 1910 by the National Dental Association.[9] With these endorsements, it became easier to gain the interest of a manufacturer, but with the provision that the profession must dictate the changes they wished made. This was something of which not even Dr.

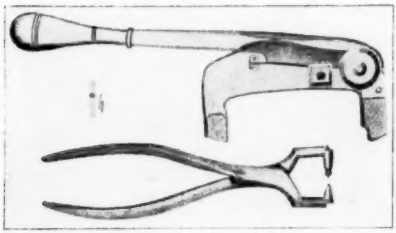

Fig. 12.—Platina rivet instruments, 1844. (Goddard.)

Williams had a clear conception. With the stage all set, immediate action was necessary and Dr. Williams set to work.

"In the progress of his investigation, thousands of extracted teeth were sorted, looked over and carefully examined. One day, Dr. Williams was struck by the fact that unconsciously the teeth he was placing in one pile were more or less square in general outline, those in another pile were tapering and those in a third were ovoid."

"Could it be possible that face form and tooth form were related and that this relationship had a direct bearing on esthetic harmony? Could it be possible that this was the solution of the problem? Dr. Williams was strongly impressed that it might be and the next morning hurried to a London museum to study the shape of skulls (Fig. 6) as compared with the shape of the teeth in the skulls. The time he spent in the museum that morning strengthened his first impression more than ever, but true scientist that he was, he gathered more data and made a long exhaustive study before announcing his theory.

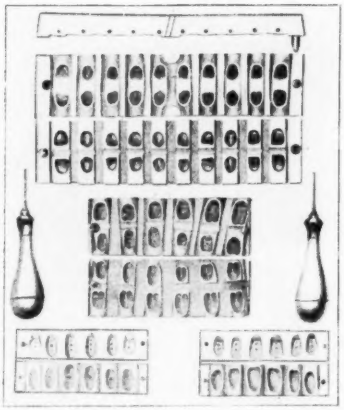

Fig. 13.—Molds for teeth, 1844. (Goddard.)

"The new theory was revolutionary. The previous theory had been that tooth form should harmonize with temperament. (Fig. 6.) To form a basis for the old theory, four temperaments were recognized—the lymphatic, the sanguine, the bilious and the nervous. It was considered that these basic temperaments were seldom found alone but usually in combination. Thus, there were the lymphaticosanguine temperament, the lymphaticobilious temperament, the lymphaticonervous temperament, and many other combinations, a long, intricate, complicated classification, although the writers

9. Tr. N. D. A., 1910.

of the time that the temperamental theory was in vogue endeavored to lead one to believe that the selection of teeth was a simple procedure. One reads in one of the texts that 'having diagnosed the binary compound of the person under observation, turn to the temperamental characteristics of the teeth which accompany that compound . . . and the proper teeth can be readily selected.'[10]

"The new idea is certainly more scientific and the selection of teeth as to size,

Fig. 14.—Coke muffle furnace, 1844. (Goddard.)

form and shade is unquestionably a more simple procedure.

"The theory of agreement between face form and tooth form has stood the test of time, and now the forms of anterior teeth supplied by practically all of the manufacturers are based either directly or indirectly upon it.

"An added convenience is that the teeth are supplied to us carded on wax and in practically any combination one may desire, full sets of twenty-eight or in fractional sets—anteriors in sixes, and posteriors in eighths." These peculiar forms of posterior teeth are the channel posteriors teeth originated by Dr. Victor H. Sears of New York and the inverted cusp teeth originated by Dr. Rupert E. Hall of Chicago. (Fig. 7.)

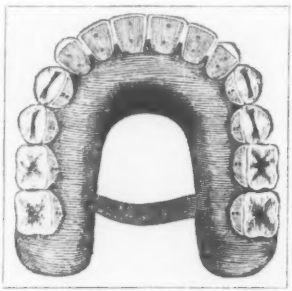

Fig. 15.—Early forms of teeth, with single grooves on bicuspids and crossed grooves on molars formed by three sided file. (Harris.)

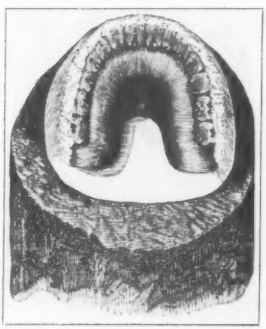

Fig. 16.—Gold base invested for soldering, 1848. (Harris.)

The old man looked them all over in wonderment and then said: "How fortunate you should consider yourself that you have teeth with which to work that are so realistic as to form and shade, and that are in such convenient gradations as to size. They certainly are a marked im-

10. Essig, C. J.: American Text-Book of Prosthetic Dentistry, Ed. 2, Philadelphia: Lea Bros. & Co., 1900, p. 633.

provement over those with which we had to work.

"We used to call them mineral teeth, and when I started work back in 1830, they were just coming into use. The first mineral teeth were pretty crude, but before I finished practicing, many improvements had been developed and we began to think they had reached perfection. After seeing these, I realize that we were mistaken.

"Mineral teeth were introduced into this country by Dr. A. A. Plantou, a Frenchman, who brought a supply with him when he arrived from Paris to engage in practice in Philadelphia in 1817. Later, Dr. Plantou made some teeth and to him was given the credit of being the first in the United States to manufacture mineral teeth.

"Notwithstanding the serious and various objections to the human teeth and the ivory teeth used before the introduction of the mineral teeth (Fig. 8), dentists were slow in adopting the innovation. In 1830, when I entered on my apprenticeship, and for some time after, human teeth and ivory teeth were still being used, especially by the men in the regions remote from the more populous centers. (Figs. 9-10.) This lack of enthusiasm in adopting the new teeth was due not only to the fact that there was little opportunity for many of the men to mingle and to learn about this new product, but also to the inferior quality of the teeth as first produced. I remember reading in 'The Family Dentist,' written in 1822 by Josiah F. Flagg, this criticism: 'The mineral or china teeth are very imperfect. They have an opaque and earthy appearance, are brittle, and the sensation they produce when brought into contact with the natural teeth in mastication is very disagreeable.'

"The shape of the front teeth introduced by Plantou was like a split bean. (Fig. 11.) On the lip side, they were rounded, and on the tongue side they were flat. 'Lengthwise across this flat back was formed before the baking, a half-round groove in each side of which were in-

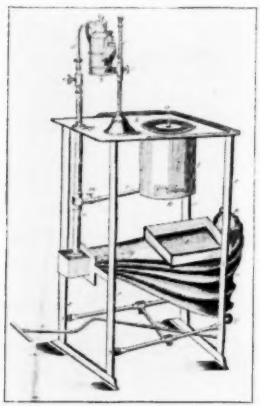

Fig. 17.—Somerby's blow-pipe and furnace, 1848. (Harris.)

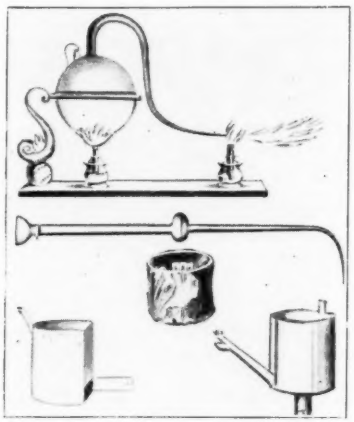

Fig. 18.—Instruments for soldering, 1844. (Goddard.)

serted small pieces of platinum. This groove was for the introduction of a gold wire, around which the platina points were hammered, and solder flowed on the metals, thus securing the wire to the tooth.'[11]

"Later, provision was made for the gold pivot by running a hole vertically through the tooth. The pivot (Fig. 12)

Fig. 19.—Roberts' self-regulating vulcanizer, 1860. (Dental Cosmos.)

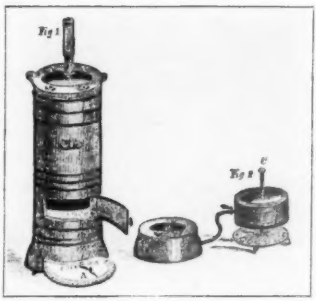

Fig. 20.—Roberts' vulcanizer using either gas or alcohol, 1860. (Dental Cosmos.)

was first soldered to the metal base and, after the tooth was placed in position on the pivot, the pivot was headed or riveted. These heads would soon wear down and the teeth would become loose.

"The next plan followed was to bake a platina tube in the tooth. When these teeth were placed in position on the rivets, sulphur as a cementing substance was placed between the rivets and the tubes and melted. Instead of sulphur, some men used pewter solder, but this was objectionable on account of the metallic taste. Later, when vulcanite came into use, pins were placed on the lingual and were baked in the porcelain.

"Human teeth, when used, were fastened to gold pivots by means of silk floss. Ivory teeth, if used in connection

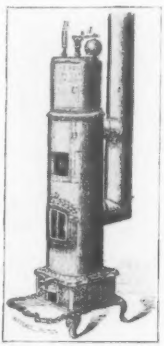

Fig. 21.—Vulcanizer heated by coal, 1860. (Dental Cosmos.)

with an ivory base, had one distinct advantage: they were securely attached because the teeth and the base were carved from one piece of ivory.

"The commercial manufacture of teeth also began in my time. (Figs. 13-14.) At first, dentists wishing to use mineral teeth were forced to make their own supply; otherwise, they were not available. The work was tedious, it took a lot of time and often the results were not very satisfactory.

"A man by the name of Samuel W.

11. American Academy of Dental Science: History of Dental and Oral Science in America, Philadelphia: Samuel S. White, 1876, p. 21.

Stockton saw an opportunity for a business venture. He began to experiment with the making of mineral teeth in 1825, and by 1830 the teeth manufactured by him 'became well and widely known and soon thereafter were accepted and used as the best then procurable.[12] The bodies of these teeth were opaque and uniform in color throughout their whole extent; the gum enamel was a smooth paint applied on the surface before final vitrefaction of the tooth; the grinding surfaces of the bicuspids and molars were formed by a three-sided file, in single or crossed grooves (Fig. 15);

Fig. 22.—Advertisement in Dental Cosmos, 1860.

each tooth was of uniform thickness from side to side.'[13]

One of the drawbacks about Stockton's product was that he continually varied his formulas and some of his best teeth were produced by mere accident.

"Even as late as 1845, Stockton's manufacture was the most extensive in this country. His greatest yearly production was 500,000. His stock was kept in bulk, in bottles—quite a contrast to your present convenient methods of having the teeth sorted and carded on wax.

"Stockton had a nephew, Samuel S. White. While serving an apprenticeship with his uncle, White became interested in experimenting. In 1844, he branched out for himself by manufacturing teeth in a small way in a garret of a dwelling house in Philadelphia. Being of an inventive turn of mind, White brought out several important improvements. He successfully worked out the method of baking pins in porcelain. He

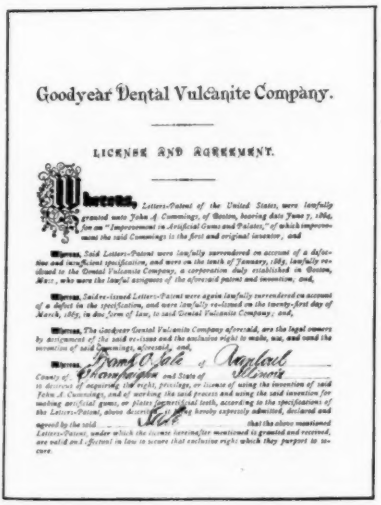

Fig. 23.—License required by any one using vulcanite for dental purposes, until the Cumming's patent expired, June 7, 1881. (Clapp.)

originated several radical changes in the shapes of the pins—in 1850, one that was bell-shaped; in 1863, one that was double-headed; in 1872, one that was foot-shaped. He also made marked improvement in the shapes of the teeth and in the composition of the porcelain."

Seeing on the table a flasked case which had been separated and from which the wax had been removed preparatory

12. Footnote 11, p. 25.
13. Footnote 12, p. 25.

to packing with rubber, the old gentleman suddenly changed the subject by injecting the question, "What would you men today think if you had to carve out a base to fit a cast?

"In the 1830's, ivory was one of the principal materials used for denture bases, and to carve a piece of ivory to fit a plaster cast was one of the first things

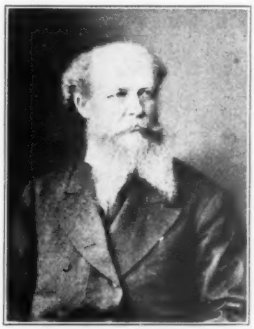

Fig. 24.—Samuel S. White. (Dental Cosmos.)

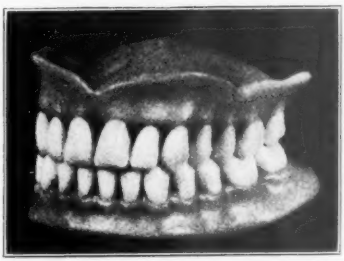

Fig. 25.—Dentures made with recent material, one of the resins.

I had to learn. As you can imagine, it was extremely difficult and it was a long time before I became proficient. To do this work, the surface of the plaster cast was first treated with a coating of wax and resin to prevent the penetration of the coloring matter and was then painted with rose-pink and oil. The block of ivory was then pressed against the cast. The points to which the coloring matter adhered indicated the areas where the ivory should be carved. The process of painting and sculpturing was continued until the ivory came in close contact with every inequality of the surface.[14] Antiquated as this method may

Fig. 26.—John Allen. (Thorpe.)

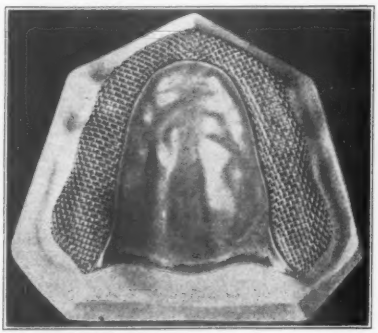

Fig. 27.—Recent denture base materials, an alloy similar to stainless steel.

seem, Ash and Sons of London carried a stock of ivory blocks as late as 1875.[15]

14. Tomes, John: Dental Physiology and Surgery, London: John W. Parker, 1849, p. 366.

15. Taylor, J. A.: History of Dentistry, Philadelphia: Lea and Febiger, 1922, p. 143.

"Gold, while not having so ancient a history as ivory, had also been used for years. It was considered probable that Dr. James Gardette of Philadelphia was the first to use a gold base in this country. 'He used gold as a plate certainly in 1787, and very probably for some time before.'[16] Gold (Figs. 16-18) plate was more easily handled than ivory because it could be swaged, but it was too expensive for poor people. On this account, silver many times was used in

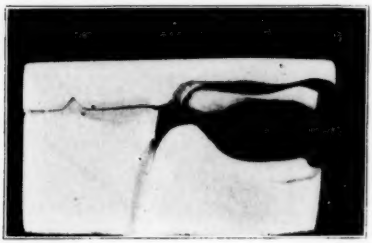

Fig. 28.—Plaster articulator, originating with J. B. Gariot, 1805.

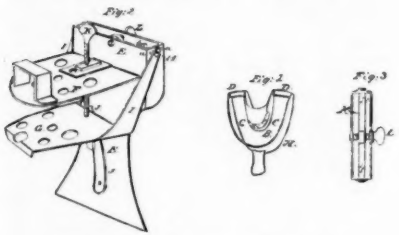

Fig. 29.—Evans' articulator, 1840.

place of gold. To find a metal substitute even more economical than silver, attempts were made to employ tin, but with little success.

"In this search for a serviceable but economical material which could be used for denture bases, it seems strange that the dental world did not adopt rubber sooner than it did. 'In 1839 by dropping on a hot stove some india rubber mixed with sulphur, Charles Goodyear discovered accidentally the process for the vulcanization of rubber. In 1844, he had perfected his process and his first patent was granted.'[17] But it was not until 1855 that it was applied in dentis-

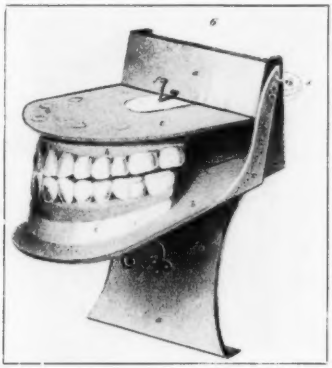

Fig. 30.—Evans' articulator.

Fig. 31.—W. G. A. Bonwill. (Thorpe.)

try. In that year 'Charles Goodyear, Jr., obtained in England a patent for

16. Footnote 11, p. 27.

17. Encyclopedia Brittanica, Ed. 13., Vol. 12, p. 240.

making a dental plate of hard rubber, in which the teeth were secured before the compound was vulcanized. This was the first recorded or published suggestion of this use of the new material.'[18]

"For a time, vulcanite almost supplanted gold and silver as a base for artificial dentures and its use 'developed a generation of practitioners deficient in that high degree of skill'[19] which we older men deemed so necessary for dental work and of which we had been so proud. (Figs. 19-22.)

"The process of vulcanizing rubber had been patented and the process patent began to make trouble for the dentists. The fees for a license (Fig. 23) to use the

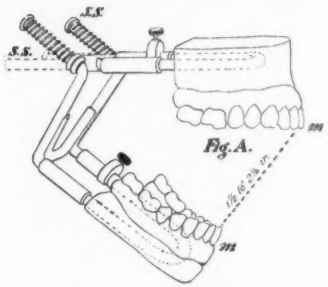

Fig. 32.—Bonwill's articulator, 1858.

process were excessive; the prices for the rubber were high. Some men acquiesced and paid the license fees demanded; some were defiant. Against the latter, suits sprang up all over the country for infringement of the patent and these suits resulted 'uniformly in favor of the plaintiffs'—the rubber company.[20] 'The feeling in the profession against the patentees and their action became very decided, and, early in the history of rubber litigations, dental protective societies and unions were formed in all parts of the country, for the purpose of assisting any who might sustain suits brought against them. Contributions were made and considerable sums were raised.'[21] What was the ultimate outcome of this controversy?"

I informed my visitor that adverse decisions against the dentists continued to be made. To escape payment of royalty legally began to look hopeless. A test case was tried in the lower courts of Massachusetts. The decision rendered was in favor of the rubber company. An appeal of this case was carried to the Supreme Court of the United States. But there was no relief: the Supreme Court sustained the decision of the lower

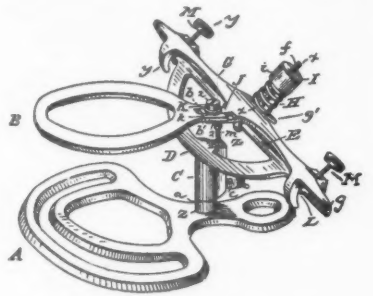

Fig. 33.—Hayes' articulator, 1889.

court.[22] The free use of rubber was not possible until the patent rights expired.[23]

"Samuel S. White (Fig. 24), the manufacturer of whom you spoke, rendered very valuable assistance to the dentists in fighting their cause and

18. Footnote 11, p. 30.
19. Footnote 17, Vol. 8, p. 53.
20. Footnote 11, p. 18.
21. Footnote 11, p. 32.
22. White, S. S.: Vulcanite Litigation, Final Decision, D. Cosmos, 19: 146 (March) 1877.
23. Cummings patent was granted for term of seventeen years from June 7, 1864. It will expire June 7, 1881; answer to query, D. Cosmos, 20: 180 (March) 1878.

especially in carrying the case to the Supreme Court.

"Until the discovery of vulcanite, the base materials which had met with success, had been materials which remained in solid form while the desired shape was being worked out. With the discovery of vulcanite, the possibility of using materials plastic in form while being shaped, then capable of being changed into solid form, was brought to light. The controversy over vulcanite, and the barriers to its use which had been thrown up, led naturally to a search for other materials which might be made plastic, formed into shape and then solidified.

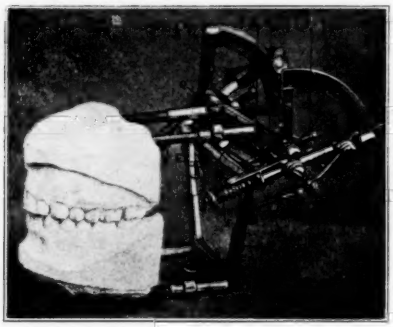

Fig. 34.—Walker's articulator, 1896. (Prothero.)

"Collodion was one of the first of these. Its use originated with John McIntosh, who patented his process in England in 1859. No reliable results were attainable with this material until improvements were made by Dr. J. A. McClellan. "Rose-pearl," the flowery name he gave his material, was a better material, but the method of manipulation remained complicated until a simplified process was presented by Isiah Smith Hyatt and John W. Hyatt, Jr., in 1870. 'They called their material celluloid and apparently solved the problem of converting collodion into a homogeneous and durable solid.'[24] Their compound was essentially a mixture of cellulose fiber and finely comminuted camphor gum to which was added a small amount of coloring matter. Looked upon with favor for a time, continued use revealed that celluloid had the undesirable tendencies of warping and staining and its use was gradually discontinued.

"Fifty years later, necessity again brought a like material into use. At the time of the World War, Germany, owing to its shortage of rubber, revived the use of the cellulose base material. After

Fig. 35.—Alfred Gysi. (Dental Cosmos.)

the war, it was introduced into other countries. On the basis of claims of improvement in composition, extravagant assertions were made, and there was a clamor of acceptance and use for a time, but it was soon discovered that the cellulose bases left much to be desired.

"The fresh enthusiasm which arose about fifteen years ago, and which continues, in a search for a new base material, was probably due, in a measure at

24. Footnote 11, p. 34.

least, to the reintroduction of the cellulose mterials. Though deficient in many respects, celluloid can be produced in more realistic shades of pink than have ever been attainable in pink rubber. This recent search has been for a material which retained this good feature and which eliminated the imperfections.

"In this search, the wizardry of modern chemistry has played a leading part. We have seen things come out of the magician's hat, but have understood little that went on inside the hat. We have been told from what a product was derived, but have been told little about the process of derivation.

"One of these first materials to be brought out was a resin or resinoid which was derived from a combination of phenol and formaldehyde. The material was dense and was a good conductor of heat and cold; but it was brittle and hard to repair when broken, and time revealed that its color would fade.

"Efforts to overcome the defects of the first resin produced one derived from glycerine. Although the defects were overcome to a marked degree, the technic was too exacting and elaborate to be followed except in laboratories with expensive equipment.

"Within the past year, a third resin (Fig. 25), this time evolved by a mysterious process from acetylene and ethylene gases, has been brought into use. The claims that it is dense and strong, that it is a good conductor of heat and cold, that it can be manipulated by a simple technic and with inexpensive equipment, seem to be well founded and, if time proves that the material is stable and that its color remains constant, it may come into general use. Time will tell."

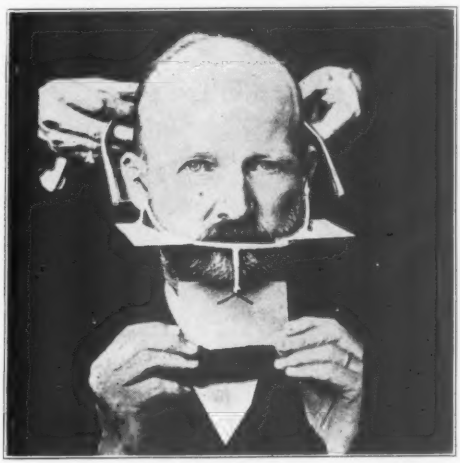

Fig. 36.—Method of making gothic arch tracing originated by Gysi. (Dentists' Supply Company.)

"Your description of the 'trials and tribulations' which have been encountered in producing a resin," spoke up my visitor, "recalls to my mind some of the difficulties which had to be overcome in formulating a technic and in stabilizing

the color for 'continuous gum' dentures. In my day, these dentures were considered the most perfect and artistic of all. They required great skill and experience and the men who could make them were considered very able workmen.

"The method of making them originated in France in the early part of the nineteenth century.

M. de Chemant, the originator, constructed his denture in one piece and painted the gum portion after the fusing process had been accomplished. This paint was easily destroyed by wear. Another Frenchman, M. Delabarre, after trying unsuccessfully to substitute jeweler's enamel for M. de Chemant's

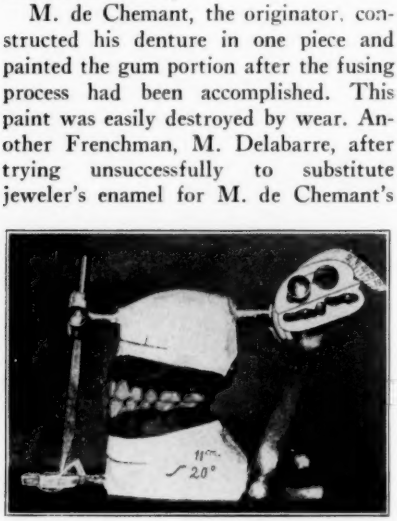

Fig. 37.—Gysi's articulator, 1910.

paint, conceived the idea of embedding the separate teeth in the base of the denture and of joining them to the base with a porcelain into which coloring matter had been incorporated. This latter porcelain would fuse at a lower temperature than either the teeth or the base.

"After its introduction into this country, several men experimented with the process, but it was not until Dr. John Allen (Fig. 26) of Cincinnati began working with it, in 1846, that any marked advancement was made."

"Though still considered the acme of perfection," I informed my visitor, "very few continuous gum dentures are made at the present time. The method of attaching the teeth to a platinum base and of fusing porcelain about them, as introduced by Dr. Allen in 1855, is essentially the method used in making these dentures today.

"A metal which has been used for denture bases for the past several years is an alloy which is similar to a stainless steel (Fig. 27). Well protected by process patents and by the prohibitive costs for equipment, the work of swaging and soldering these bases is practically restricted to the originating companies. Although this material has many desirable qualities, its use will be limited owing to the barriers which have been thrown up around it."

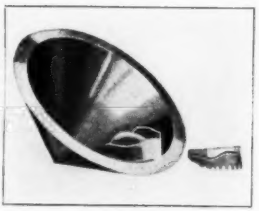

Fig. 38.—Conical theory of Rupert E. Hall. (Dental Cosmos.)

"I presume that this is the instrument upon which you articulate teeth," remarked the old gentleman, picking up an articulator that I had in the laboratory. "It surely is very different from any articulator that we had in my day. I hardly recognize it as an articulator.

"The one that was in use when I learned dentistry was the plaster articulator (Fig. 28) originated by Dr. J. B. Gariot, in 1805. It merely provided for an opening and closing movement. It was constructed by building posterior extensions of plaster to the upper and the lower casts. A transverse ridge of plaster on one extension fitting into a notch on

the other extension was the guiding principle. A new articulator was built for each case.

"In an articulator patented by Dr. D. T. Evans, Aug. 28, 1840 (Figs. 29-30), provision was made for the first time for the lateral movement of the mandible. A rotation center located in the center of the frame and two short horizonal condyle slots made these movements possible. In one respect, the Evans articulator was more nearly anatomic than this one you have. The mandibular portion of the Evans articulator was the movable portion. The maxillary portion was fastened to the table and was thus held stationary. Also, by means of holes in the

Fig. 39.—Spherical theory of G. S. Monson. (Dental Cosmos.)

part representing the ramus, the length of the ramus could be altered.[25]

"When were these other changes introduced?" asked the old man.

"Almost fifty years elapsed," I replied, "between the time Evans patented his articulator and the time of the next radical change in principle. Perhaps you disagree with me on that point, having in mind Dr. W. G. A. Bonwill (Fig. 31), about whose work I presume you know. Although Bonwill, in 1864, originated and reported the three-point contact theory of occlusion and may 'be justly called the father of balanced occlusion' and although 'his work inspired all later workers in this field of endeavor,' the articulator he designed in 1858 'showed no advance in principle, as to movements, over the Evans articulator.'[26] I will grant that the Bonwill articulator (Fig. 32) was simpler and more easily handled.

"The new principle which was embodied in the articulator patented by R. S. Hayes, Jan. 22, 1889, was the provision for a downward as well as for a forward movement of the condyle. (Fig. 33.) The condyle paths were steeply in-

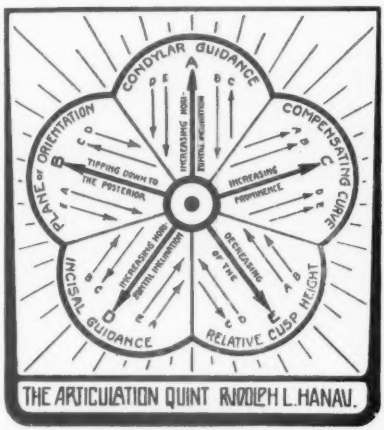

Fig. 40.—Condensation and simplification in statement of laws of articulation. (Hanau.)

clined and no provision was made for adjusting them.

"Although Dr. Bowditch and Dr. Luce of Harvard, in 1889,[27] reported new findings relative to condylar movements, their conclusions were not widely publicized and it remained for Dr. W. E. Walker, of Pass Christian, Miss., in

25. Footnote 4, plate 30.

26. Hall, R. E.: Development of the Articulator, J.A.D.A., 17:3 (Jan.) 1930.

27. Boston S. and M. J., January, 1889.

1896, to call the attention of the profession to some of the more intricate things relative to the temporomandibular articulation.

"The Walker articulator (Fig. 34) was the first articulator to embody 'adjustable means for reproducing the varying angle of the downward movement of the condyles' and it was 'the first articulator to embody adjustable construction for reproducing variable rotation centers for lateral movements.'[26] Walker was a prophet ahead of his time. The dental world failed to grasp the significance of his findings and his articulator was not widely used. In fact, so much time

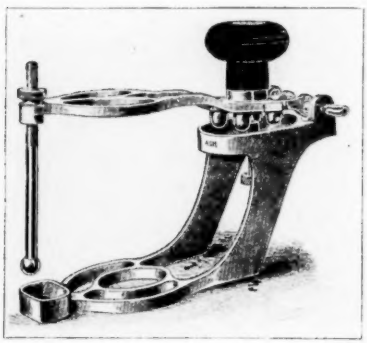

Fig. 41.—Luce's articulator, 1911. (Prothero.)

elapsed before the Walker discoveries were put into practical use that Walker's name was almost forgotten and credit for his discoveries is often thought of as belonging to others. But Walker was a real pioneer and deserves much credit.

"It remained for Dr. Alfred Gysi (Fig. 35), of Switzerland, in 1910, nearly fifteen years later, to uncover and reestablish this old and almost forgotten trail blazed by Walker. Gysi, too, was a pioneer and explorer, and, in uncovering the old path, made several new discoveries. To Gysi should be given the credit for the method of registering the movement of the incisor point in a horizontal plane—Gysi gothic arch (Fig. 36)—for the inclusion of the Balkwell-Bennett movement in an articulator and for the origin of the incisor point and guide. (Fig. 37.) While C. E. Luce of Germany patented the latter feature in September, 1910, Gysi had described it in writings in January, 1910."

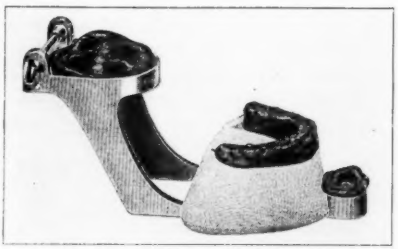

Fig. 42.—Lower frame, Luce's articulator. (Prothero.)

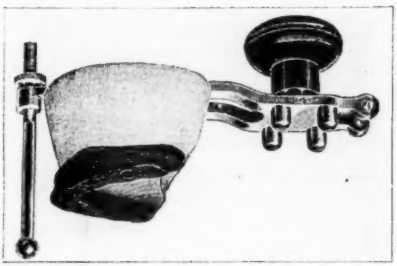

Fig. 43.—Upper frame, Luce's articulator. (Prothero.)

"What is the Balkwell-Bennett movement?" inquired my visitor.

"Involved with the lateral movement of the mandible is a secondary movement in which the condyle on the balancing side moves slightly inward and the condyle on the working side slightly outward from the sagittal plane. This is known as the Bennett or the Balkwell-

Bennett movement. Whether or not Balkwell, in 1866, fully recognized this movement, one must infer from his writings that he had a faint idea that there was such a movement.[26] It was not until Norman G. Bennett of England rediscovered this movement that much significance was given it and provision made for it in articulators.

"Since the rediscovery by Bennett, no radically new movement of the mandible has been brought to light. Nevertheless, the past two decades has probably seen more earnest study given to mandibular

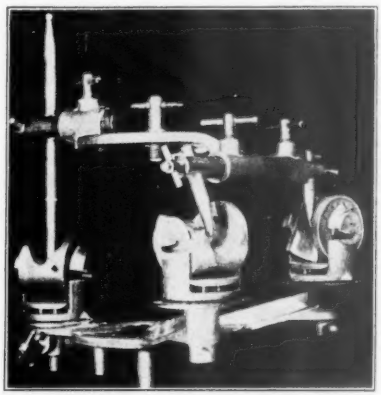

Fig. 44.—Hall's three-dimensional articulator, 1926.

movements, to the problem of articulation and to the development of various types of articulators than any preceding period. Many theories have been advanced: the conical theory of Dr. Hall (Fig. 38), the spherical theory of the late Dr. Monson (Fig. 39), tooth guidance instead of condylar guidance, and others. A condensation and simplification in statement of the laws of articulation was presented by the late Rudolph L. Hanau (Fig. 40), who also called attention to the effect of resilient tissues beneath denture bases during mandibular movements. Heated arguments have taken place to prove and to disprove; but, through it all, there has been an earnest endeavor to get at the truth, to determine what should be retained and what should be discarded, and progress has been made.

"During this period, instruments that will measure mandibular movements more accurately and upon which the general direction and degree of movements equivalent to those of the mandible can be closely simulated, have been perfected. The best of these are based on

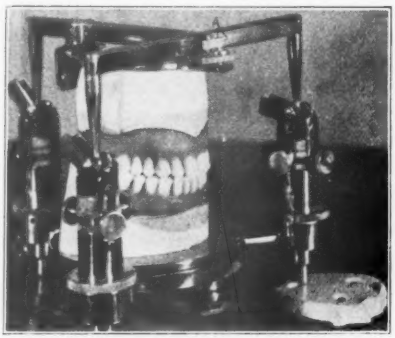

Fig. 45.—Stansbery tripod. (Dental Digest.)

the "three-dimensional" principle. An articulator of this type provides 'guides, universally adjustable to record accurately, positional relations of all three points of the Bonwill triangle in three dimensions, simultaneously.'[28]

"The principle involved in the three-dimensional type was employed first by C. E. Luce, Stuttgart, Germany. (Fig. 41.) A patent was received in the United States in 1911. Attached to a lower

28. Hall, R. E.: Full Denture Construction, J.A.D.A., 16:1157 (July) 1929.

frame (Fig. 42) of his articulator were bowls in which compound could be adapted. Made to come in contact with the compound in the bowls were vertical metal pivots extending downward from an upper frame. (Fig. 43.) By means of jaw relationship records taken previously in the mouth, a series of depressions could be formed in the compound by the pivots. The depth of the depressions and their location relative to one another made possible the measurement of the direction, type and degree of movement which the mandible had undergone when the relationship records were taken. Owing to the instability of modeling compound, records which are recorded in it are unreliable, and it was not until the principle was embodied in an all-metal articulator in which metal channels instead of depressions in compound served as the guides that its full value was attained. But Luce's idea was unique and pointed the direction to a new basic form for articulators.

"Although John A. Lentz, of Phoenix, Ariz., was given a patent for a metal three-dimensional articulator in 1925, much credit for introducing this type of articulator is due Rupert E. Hall of Chicago, who constructed an all-metal, three-dimensional articulator (Fig. 44) and demonstrated its use at the International Dental Congress at Philadelphia in 1926, and to C. J. Stansbery, of Los Angeles, whose plaster checkbite method made possible the accurate manipulation of this type of articulator. Dr. Stansbery (Fig. 45) also has developed an instrument of this type and to his tripod instrument he has added many of the working parts and perfected them. To George Phillips, of Boston, belongs the credit for discovering the central stress bearing point.

"Another interesting thing about these instruments is that the technic involved, while different, is not complicated and the results obtained are very gratifying."

"I have enjoyed my visit and I regret that it is now time for me to go," announced the old gentleman. "From taking an impression in wax, to taking one in compound; from sculpturing a base out of ivory, to pressing a base in some plastic material; from human and crude forms of mineral teeth to teeth in anatomic forms and of fine quality porcelain; from casts of soft plaster to casts of stonelike hardness; from an articulator embodying one mandibular movement, to one on which practically all movements of the mandible can be produced; from loosely fitting dentures supported by means of springs, to accurately fitting dentures needing no auxiliary supports—that is the picture of the advancement made in full denture construction during the past century. I am satisfied that in the hands of modern dentistry the torch of progress is in safe keeping."

With these words, he bade me goodbye and slowly trudged from the office.

The dear old pioneer—representative of the grand group of workers who have gone before. What a rich heritage they handed down and how much credit is due them for what we now enjoy!

Have we reached perfection? No. But with scientific research keyed to the high pitch it is today, one cannot visualize the changes and advancement that the future is holding in store.

Would that we, one hundred years from now, could return for a short visit.

PREVENTION THROUGH SYSTEMATIZED TREATMENT OF CHILDREN'S TEETH*

By HENRY A. HONOROFF, D.D.S., Chicago, Ill.

WHILE there are divergent opinions among dental authorities in regard to the etiology of caries, there is at the same time practical unanimity of opinion among them as to the necessity of early treatment of dental disorders for the purpose of arresting caries.

By all schools of thought, the importance of early care has been pointed out as the paramount factor in the prevention of many diseases, and in the light of present day knowledge of the rôle played by prevention in human economy, it would seem that the course to be pursued by the dental profession is clearly indicated. It should be directed toward greater effort and more generalized application to the treatment of children's teeth.

Dentistry cannot function completely as a health-service in the social structure of civilized people if it does not include in the scope of its activity serious consideration of improving the deplorable pathologic condition now so prevalent in the mouths of most children.

To cope successfully with this condition, the dental profession must emerge from its attitude of indifference regarding child dentistry or of passive willingness to treat the teeth of children, and embark on a program of active participation in making early care of children's teeth possible, if not compulsory.

This can be attained only through an intensified application of the profession to the dissemination of knowledge among the laity of simple facts of mouth hygiene, and by prevailing on parents to bring their children to the dental office at an early age.

Observations made through eighteen years of association with the dental staff of Marks Nathan Orphans' Home of Chicago, and the conduct for twenty years of a private dental practice in which children have always been welcome patients, have led me to conclude that it is entirely within the province of the general practitioner of dentistry to bring about ideal oral conditions in children without much deviation from the established procedures in operative dentistry.

As far as dental health is concerned, I have noted that the little patients from the orphans' home have a distinct advantage over the average school child. These institutional children have clean mouths, no infection, no large cavities, practically no loss of first permanent molars and very little of preventable malocclusion. The percentage of cavities found in the teeth of these institutionally cared for children during their regular periodic dental examinations is much smaller than that found in any similar

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 8, 1933.

group of children reared in their own homes under the care of devoted parents. It may be well to point out at this time that, when first admitted to the institution, the orphaned child has not, as a rule, abundant health and vigor. At the first examination, their physical condition is generally not up to par. The case histories of many of these children point to unfavorable hereditary tendencies.

It cannot be presumed, therefore, that these children are more resistant to dental caries than are any other children.

The routine of institutional life, regular sleeping hours, well ventilated dormitories, recreation, general cleanliness, personal hygiene and a diet that is up to standard nutritional requirements, all have a beneficial influence on general physical conditions. They, no doubt, also exert a favorable influence on the teeth of these growing children.

These conditions make a fine background for a dental health picture. They are only of secondary importance from the standpoint of actual prevention of

TABLE 1.—DENTAL RECORD OF THE MARKS NATHAN ORPHANS' HOME

Boys					Girls				
Age	Number Examined	Cavities in Permanent Teeth	Fillings in Permanent Teeth	Permanent Teeth Extracted	Age	Number Examined	Cavities in Permanent Teeth	Fillings in Permanent Teeth	Permanent Teeth Extracted
6	1	1	.....	.....	6	1	.....	.....	.....
7	4	.....	3	.....	8	2	.....	3	.....
8	4	2	8	.....	9	3	.....	13	.....
9	7	3	21	.....	10	4	1	9	.....
10	12	15	31	.....	11	7	4	23	.....
11	5	3	13	.....	12	10	.....	46	.....
12	17	16	61	2	13	5	2	26	.....
13	12	15	49	.....	14	12	7	57	5
14	23	21	120	7	15	12	7	67	1
15	19	20	87	4	16	18	16	103	6
16	18	22	103	6	17	5	2	27	.....
17	6	1	42	2	18	2	1	16	4
18	3	4	20	.....	.....	.....	.....	.....	.....
	131	123	558	21		81	40	380	16

It may be logically supposed that, if left unattended, this orphan group would succumb to the ravages of dental decay much more quickly than children who have a more favorable family and case history.

The condition that favors the dental health of the particular group of orphans under discussion is therefore to be found within the confines of the institution that looks after their welfare, and in the methods of care employed therein.

dental decay and the maintenance of sound teeth. The factors that are of the greatest importance and stand out, towering high above every known force in the promotion of what may be called an ideal dental condition, are principally (1) timely care and strict adherence to periodic dental examinations and (2) absolute cooperation between patient and dentist, which only a well regulated institution can make possible.

At the Marks Nathan Orphans'

Home, there are now 230 boys and girls ranging in age from 6 to 18 years. All of these children receive dental care as they are in need of it. This means that 100 per cent of the child population of the institution is receiving 100 per cent dental attention. Such a condition, of course, does not exist in private homes. Public school dental statistics compiled by the Bureau of Dental Hygiene of the Chicago Board of Health reveal the appalling fact that 96 per cent of all children examined have defective teeth to the extent of 4.5 large cavities per child, and 66 per cent of all children have dirty mouths.

A study of the number and kind of cavities and fillings found in the mouths of 212 children of the Marks Nathan Orphans' Home at the time of the last semiannual examination discloses some significant facts. (Table 1.)

One hundred thirty-one boys have 123 cavities, most of them pit and fissure in the incipient stage of decay. This number averages less than one cavity per boy. The average number of fillings per boy was a little over 4.

In the eighty-one girls examined, only forty small cavities were found, or slightly less than one half of one cavity per girl. The number of fillings per each girl was found to be about 4.7.

The gingival condition was found to

TABLE 2.—TYPES OF CAVITIES GENERALLY FOUND IN CHILDREN'S TEETH

Class of Cavities and Percentage

131 Boys, 6-18 years			81 Girls, 6-18 years		
Type	No.	Per Cent	Type	No.	Per Cent
Simple occlusal on molars	82	65	Simple occlusal on molars	34	85
Two-surface on molars	19	15	Two-surface on molars	1	2.5
Buccal pits on molars	5	4	Buccal pits on molars	1	2.5
Two-surface on bicuspids	10	8	Two-surface on bicuspids	3	7.5
Simple occlusal on bicuspids	2	1.5	Simple occlusal on bicuspids		
Proximal on incisors	8	6.5	Pits on incisors	1	2.5
	126	100		40	100

Class of Fillings and Percentage

Type	No.	Per Cent	Type	No.	Per Cent
Simple occlusal on molars	418	75	Simple occlusal on molars	290	76
Two-surface on molars	52	9	Two-surface on molars	28	7.5
Buccal pits on molars	38	7	Buccal pits on molars	17	4.5
Two-surface on bicuspids	25	4.5	Two-surface on bicuspids	15	4
Simple occlusal on bicuspids	12	2	Simple occlusal on bicuspids	18	4.5
Lingual pits on incisors	8	1.5	Lingual pits on incisors	7	2
Proximal surface on incisors	5	1	Proximal surface on incisors	5	1.5
	558	100		380	100

be most excellent and the teeth of practically all the children were free of calcareous or serumnal deposits.

The boys had lost sixteen first permanent molars and five bicuspids. The girls had lost five first permanent molars, six bicuspids and five anterior teeth. Only one child out of every ten had a first permanent molar missing. Each child having four first permanent molars, the ratio is 1:40, or 2.5 per cent. This figure includes in it the teeth of children who entered the home with the first molars either already missing or in such a bad stage of decay and infection that extraction had to be resorted to immediately on admission. Nevertheless this condition is to be looked on as very favorable when compared with the condition of public school children.

Murrey, in a survey of first molars of 2,500 children, found that children between 5 and 6 years retained all of the first permanent molars. Between 9 and 10 years, 3.9 per cent of the upper and 13.7 per cent of the lower first permanent molars were lost. Between 13 and 14 years, 15.2 per cent of the upper and 40.1 per cent of the lower first permanent molars were lost. The average loss of these molars was 18 per cent. (Table 2.)

The figures in Table 2 show the types of cavities generally found in children's teeth. The ratio between the various individual types of cavities and fillings and the whole number of cavities and fillings found in the 212 children examined points to certain definite proportions in selected localities.

CLASS OF CAVITIES AND FILLINGS; PERCENTAGE

It is to be noted from Table 2 that the incidence of decay is three times as great on the occlusal surfaces of molars as it is on all other surfaces of all teeth taken together.

The incidence of decay on proximoclusal surfaces of bicuspids is much greater than on the occlusal surfaces of these teeth. In other words, there are more proximoclusal than simple occlusal cavities on bicuspids. This is probably due to undermining of the proximal walls of bicuspid teeth by the rapid spread along the dentino-enamel junction of caries that has its beginning on the occlusal surface, and is not stopped early enough in its destructive process.

The incidence of decay on proximoclusal surfaces of molars is about one fourth that on the occlusal surfaces of the same teeth. The spread of decay from the occlusal to the proximal surfaces is less destructive to the proximal walls of molars than to the proximal walls of bicuspids.

There are more buccal pit cavities on molars than there are lingual pit cavities on incisors. The number of proximal cavities on upper incisors and cuspids in children up to 18 years of age is negligible. The proximal surfaces of lower incisor and cuspid teeth of children up to 18 years of age have practically no cavities at all.

The clinical panorama of caries, as observed over a period of many years in its actual occurrence in the teeth of growing children, is not altogether identical with the picture and characteristics of caries experimentally produced in the laboratory. Dental caries in human beings is rather obstinate in its behavior. It attacks resistant as well as nonresistant teeth, this being noted particularly where structural defects, unprotected proximal surfaces and irregular arrangement make such an attack possible.

The difference in the manifestation of the disease being chiefly in the rapidity

of its development, the process of destruction is more rapid in susceptible teeth than it is in nonsusceptible teeth.

The statistics quoted in Tables 1 and 2 give rise to questions which as yet are to be satisfactorily answered. If caries and to an infinitesimal degree, or not at all, on anterior teeth of children and young persons?

Table 3 shows the number of teeth that can be saved and the extent of prevention that can be obtained through

TABLE 3.—RECORDS OF FIFTY CHILDREN UNDER DENTAL CARE FOR TEN YEARS FROM TIME OF ERUPTION OF FIRST PERMANENT MOLARS

Boys					Girls				
Age	Time Under Treatment Years	Cavities in Permanent Teeth	Fillings in Permanent Teeth	Permanent Teeth Extracted	Age	Time Under Treatment Years	Cavities in Permanent Teeth	Fillings in Permanent Teeth	Permanent Teeth Extracted
18	9	2	7	..	18	12	..	6	..
17	12	..	8	1	17	9	2	3	..
17	10	4	6	2	17	11	1	6	..
17	12	..	3	..	17	10	2	1	..
17	12	..	12	..	17	11	1	7	..
17	11	..	3	..	17	8	..	3	..
17	10	3	7	..	16	8	..	..	..
17	9	..	5	..	16	11	1	8	..
17	10	..	5	..	16	11	2	5	..
16	9	2	6	..	16	11	2	3	1
16	10	..	4	..	15	8	2	6	..
16	10	..	3	..	15	8	2	3	..
16	10	..	8	..	15	9	1	4	..
15	8	2	7	..	15	10	..	6	..
15	10	4	9	..	14	7	1	4	..
15	9	..	3	..	14	8	..	..	..
15	9	..	2	..	13	8	..	3	..
15	10	1	6	..	13	7	..	5	..
14	8	..	8	..	13	6	..	6	..
14	7	..	5	..	12	6	2	4	..
14	9	1	4	..	12	6	1	3	..
14	9	..	3	..	12	7	..	2	..
13	6	..	3	..	11	6	..	..	..
13	8	2	5	..	11	..	..	..	..
13	7	6	3	..	..	..	..	..	..
12	7	..	3	..	..	..	..	..	..
26	..	27	138	3	24	..	20	88	1

can be arrested or produced by the use or disuse of certain diets or activators, why does it not affect all teeth alike? Why does this pathologic condition manifest itself in its most violent form only on certain surfaces of posterior teeth, early, timely and systematic operative treatment of children's teeth.

Table 3 presents a clinical study of the dental condition of fifty children who were admitted to the orphans' home between the ages of 5 and 7 years, the

approximate time of eruption of the first permanent molars. Dental treatment of these children was started before the destructive process of decay had penetrated too deeply into the permanent molars. Most of the children in this group have been in the institution nearly ten years; some have been there eleven or twelve years, and none have been there less than six years. During all these years, this group have been receiving the regular dental attention prescribed for all children there. Their teeth have been examined regularly every six months, and all defects corrected as soon as they were discovered.

The last semiannual examination disclosed an average of less than one small cavity per mouth, and 4.5 fillings per child on the average. Only four permanent molars have been lost by these fifty children in a period of ten years, two molars being lost by a susceptible child and two by nonsusceptible children. Only three first permanent molars required devitalization and root canal filling. In all

TABLE 4.—DENTAL RECORD OF FORTY UNDERWEIGHT CHILDREN ON SPECIAL DIET

Boys					Girls				
Age	Molars Filled	Other Teeth Filled	Cavities Developing in Two Years	Per Cent Underweight	Age	Molars Filled	Other Teeth Filled	Cavities Developing in Two Years	Per Cent Underweight
9	4	.....	1	7.8	9	4	3 bicuspids, 1 incisor pit	4	9.3
9	4	.....	4	8.4	10	5	.....	4	11.0
10	1	.....	0	6.2	11	2	1 bicuspid	2	16.4
10	4	.....	4	15.0	12	5	.....	6	10.2
11	3	.....	1	9.6	13	6	.....	3	8.1
12	2	1 bicuspid	4	9.4	13	4	.....	3	6.5
12	4	.....	4	8.0	13	5	.....	4	7.8
13	5	1 bicuspid, 4 incisor pits	6	8.2	13	2	.....	2	7.4
14	5	.....	2	7.3	15	3	.....	3	16.4
14	5	.....	5	10.3	15	7	.....	4	13.5
14	4	.....	4	8.2	15	6	.....	4	21.0
15	5	2 bicuspids	4	8.3	16	7	.....	1	8.1
15	5	.....	3	8.9	16	10	1 bicuspid	6	10.4
15	10	.....	3	6.5	16	4	.....	0	6.8
16	3	.....	2	6.9	16	5	2 bicuspids	4	6.8
16	4	.....	4	11.3	17	7	1 bicuspid	2	6.5
16	5	4 bicuspids	7	9.9	17	6	.....	2	10.9
17	8	4 bicuspids	8	9.9	18	8	2 bicuspids	1	6.7
17	7	1 bicuspid	4	7.4	.....	.....	.....	.....	.....
17	3	.....	0	19.2	.....	.....	.....	.....	.....
17	5	.....	2	10.2	.....	.....	.....	.....	.....
18	6	3 bicuspids	7	8.4	.....	.....	.....	.....	.....
22	102	20	79		18	94	11	55	

three of these cases, there is no apical involvement at the present time, which is seven, six and four years, respectively, after the insertion of the canal fillings.

The least susceptible child in this group required only one filling in ten years. The most susceptible child required twelve fillings in twelve years. The maximum susceptibility was found in a boy who has now reached the age of 17 years. The rapidity of the carious process has been checked in this boy, he having no cavities at all on the last semi-annual examination.

It is to be observed that the more susceptible children have retained their teeth as well as did the less susceptible ones except, of course, that the former have a greater number of fillings in their teeth than the latter.

TABLE 5.—CLASS OF CAVITIES AND FILLINGS IN FORTY UNDERWEIGHT CHILDREN ON SPECIAL DIET

Type	No.	Per Cent
Simple occlusal on molars	168	74.1
Two-surface on molars	22	9.7
Buccal pits on molars	6	2.6
Two-surface on bicuspids	18	7.9
Simple occlusal on bicuspids	8	3.5
Lingual pits on incisors	5	2.2
	227	100

This analysis shows conclusively that it is possible to maintain good dental health during the whole of the "childhood period" of teeth when the carious process is most rapid in its destruction. It also proves that, by simple operative means, the general practitioner of dentistry can save 98 per cent of all teeth. It is also possible in the same way to prevent pulp involvement and infection and make extraction unnecessary. All permanent teeth can be guided into their proper positions in the jaws without mutilation or distortion, by careful attention to the deciduous teeth. In this manner, children can be supplied with a dental mechanism that will hold good, and chew efficiently for many years after the attainment of maturity, and in most cases throughout life.

The clinical experience with caries in human teeth is that, once it is started, it can be stopped only by proper operative procedure. The characteristics of caries do not make it entirely apparent that it can be readily produced or prevented at will by dietary means in human beings as is done in laboratory rats and other animals. Neither is there much indication of the "practicability of this means (nutrition) for the arrest of existing caries," as one investigator seems to believe.

Table 5 shows the types of cavities in the teeth of underweight children who were given a special diet for two years. The percentage of affected teeth in this group is practically the same as in the children on a regular diet.

DENTAL RECORDS OF UNDERWEIGHT BOYS AND GIRLS ON SPECIAL DIET

Forty children classed as underweight have for a period of two years been given vitamin D daily in the form of a malt preparation and cod liver oil, and also an extra egg each and some cream. The number of affected teeth in this group is five and seven-tenths per child, which is slightly higher than in the general child population of the institution. This is, perhaps, due to the fact that, within the underweight group, there are two or three caries-susceptible children. Otherwise, this percentage could be considered normal. No particular indication of arrest of caries due to the extra vitamin D ration has been observed.

This is concluded from the number, size, depth and surface localization of

either cavities or fillings found in the teeth of these children on periodic examination. It is to be particularly observed that, while receiving the benefit of a special diet rich in vitamin D, the children so treated developed new cavities to the extent of three and six-tenths to each boy, and three to each girl in a period of two years. A girl of 15 showing the greatest percentage of underweight (21 per cent) has only six affected molars. On the other hand, the most susceptible boy in the group, who is 13 years of age and has five affected molars, one affected bicuspid and four affected incisors, is only 8.2 per cent underweight.

The fact that the children showing the greatest percentage of underweight do not show a proportionately great susceptibility to caries may indicate that there is no direct relationship between these two conditions. It is apparently possible for children to be underweight and still have sound teeth.

It is also possible for children in perfect health to have very bad teeth. This observation is made from the fact that the most susceptible boy in the institution, who has thirteen fillings in molars, two affected bicuspids, one molar and one bicuspid extracted at the age of 15, is reported by his physician to be in excellent physical condition.

Two sisters in one family, and a sister and brother in another family, all in good health and living under similar conditions and environment, and consuming identical food, show these contrasts. The older children in both cases have very sound teeth with one or two small cavities in the molars. The younger children have very poor teeth, being extremely susceptible to caries, and developing deep cavities at a very rapid rate.

Careful investigation of tooth cavities in all types of children and actual repeated count of them at equal intervals discloses an amazing persistence in their development. In view of this condition, which is present even when the best of nutritional methods are employed, it would seem that the etiology of dental caries is still more or less in obscurity.

Take any group of children whose dental defects have been cleared up with great dispatch as soon as detection was possible and reexamine their teeth six months later, and there will be found newly formed cavities either in the teeth that were previously examined or in new teeth that made their appearance in the mouth during the interval between the first and second examinations.

The rate at which new cavities develop in permanent molars of children receiving the best of dental care may be expected to be on an average of one-half to three-quarters cavity per child every six months.

There are other facts that frequently attract the attention of the clinical observer and impress him with their possible significance. One invariably notices the presence of ropy saliva in the mouths of individuals who have deep and broad cavities and a good deal of recurrent decay about the margins of fillings.

On the crown portions of caries-resisting or immune teeth, there are often to be found dark brown spots very firmly attached to the buccal, labial or lingual surfaces. These spots are entirely different in all of their characteristics from salivary or serumnal calculus. This probably indicates that the condition of the secretions within the oral cavity may have some effect on dental caries, either aggravating or retarding it.

In spite of enthusiasm over the marvelous possibilities of nutritional influence on the prevention of caries, we are

still confronted with the fact that the condition, in general, has not changed much. Dental caries is almost as alarmingly prevalent in childhood and in youth at this time as it was before the advent of the nutritional theory.

There seems to be much indication that the function of the saliva in this connection is still very important. The effort of research directed into the realms of salivary influence on caries may still be very profitably expanded.

of approximately the same ages as the boys show an average bite force of 143 pounds on the right side and 124 pounds on the left side. The maximum strength of bite of a boy of 18 was registered at 165 kg., or 363 pounds, and the maximum bite for a girl of 17 was 150 kg., or 330 lbs.

In a study of the 1931 dietary made by experts in nutrition from the Elizabeth McCormick Foundation, this orphanage was found to conform closely

TABLE 6.— DAILY DISTRIBUTION OF PROTEIN CALORIES (PERCENTAGE)

	Protein Calories	Fat	Carbohydrates
Marks Nathan Home	14.4	35.5	52.1
Standard	15.0	35.0	50.0

TABLE 7.— MINIMUM DIETARY REQUIREMENTS PER PERSON PER WEEK.

Standard		Marks Nathan Home
Milk	3.50 qt.	4.33 qt.
Canned tomatoes	1.19 lb.	0.41 lb.
Potatoes	4.17—7.50 lb.	2.20 lb.
Vegetables	2.00—3.00 lb.	2.50 lb.
Legumes	0.40—0.50 lb.	0.30 lb.
Fresh fruit	1.00—2.00 lb.	2.70 lb.
Dried fruit	0.43—1.00 lb.	0.36 lb.
Cereals	5.25—6.50 lb.	4.70 lb.
Eggs	3 eggs	6.91 eggs
Meats and fish	1.00—1.50 lb.	2.18 lb.

Reflecting on the highly satisfactory state of health of the teeth and their investing tissues is the fact that bite tests made with the gnathodynamometer show the strength of bite of children at the Marks Nathan Orphans' Home to be much greater than the average biting strength of other children of the same age. A group of thirty-nine boys from 15 to 18 years of age show an average bite force of 150 pounds on the right side in the molar region, and 126 pounds on the left side. A group of forty-two girls

enough to standard requirements in caloric units to be satisfactory.

In the apportionment of food in this institution, caloric values are carefully considered. The vitamin content is not used as a basis or guide in the distribution of the various dietary elements.

Vitamins A, B, C and D are furnished by the various foods used, Vitamin D predominating. What, no doubt, has a favorable influence on the teeth of the children of the Marks Nathan orphanage is the fact that the supply of calcium,

phosphorus and iron not only meets the standard requirements, but is slightly higher than these requirements. A comparison of the dietary here with the standard for minerals in grams per day is shown in Table 8.

The system of dental care followed at the Marks Nathan Orphans' Home is somewhat unique. It offers both the accuracy and promptness of institutional regulation, and also the privacy and individuality that characterize ethical professional service rendered within the environment and atmosphere of the dentist's own office.

The dental staff of Marks Nathan Orphans' Home consists of thirty dentists who voluntarily take care of the teeth of all children living in this institution. No remuneration is accepted for the service. Each member of the staff is allotted from eight to ten children for dental care. These children, as long as they stay in the orphanage, remain the patients of the particular dentist to whom they were originally assigned. They are sent to the dentist's own private office for dental treatments whenever it is found necessary. Every six months, all children undergo a thorough dental examination. These examinations are conducted by an examining board at the dental office of the orphanage. The examiners are members of the staff, who take turns in the performance of this duty. The findings of the examiners are charted on special blanks with two views of the permanent and deciduous sets of teeth. The work to be done is marked in black; the work already done, in red. From these markings, the clerical staff of the institution can keep accurate records of the dental condition of the children. They also indicate whether a child needs to be sent to the dentist. Prophylactic treatment is given each child every six months, as a matter of routine.

Extraction of teeth is the only dental work done at the orphanage office. One man is assigned the task of extraction.

Because of the highly preventive nature of the dental service in this orphans'

TABLE 8. —COMPARISON OF DIETS FOR MINERALS

	Calcium	Phosphorus	Iron
Standard	259.9	356.4	3.48
Marks Nathan Home	265.1	412.6	3.73

DAILY STANDARDS FOR MINERALS

Calcium	for children	1.00 gm. to each 1,000 calories
Iron	for children	0.005 gm. to each 1,000 calories
Phosphorus	for children over 11 years,	1.32 gm. to each 1,000 calories
Phosphorus	for children 10 years,	1.28 gm. to each 1,000 calories
Phosphorus	for children 9 years,	1.24 gm. to each 1,000 calories
Phosphorus	for children 8 years,	1.20 gm. to each 1,000 calories
Phosphorus	for children 7 years,	1.16 gm. to each 1,000 calories
Phosphorus	for children 6 years,	1.12 gm. to each 1,000 calories
Phosphorus	for children 5 years,	1.08 gm. to each 1,000 calories
Phosphorus	for children 4 years,	1.04 gm. to each 1,000 calories
Phosphorus	for children 3 years,	1.00 gm. to each 1,000 calories

home, it seldom becomes necessary to extract permanent teeth. The extractions are mostly confined to such temporary teeth as are retained in the jaws too long owing to delayed absorption, or to such teeth as become a source of gum irritation through looseness.

For dental work in the private offices of the staff, appointments are given the children. These appointments are strictly adhered to through a specially worked out system by the administration of the institution.

The younger children are always accompanied by an older child. The appointment cards indicate the time of entering and leaving the office of the operating dentist, giving an opportunity of checking up and, at the same time, teaching the child the importance of keeping appointments.

TABLE 9.—DAILY STANDARD FOR CALORIES

Boys, 15 to 18 years	3,000—3,700
Girls, 15 to 18 years	2,700—3,000
Children, 12 to 14 years	2,500—2,900
Children, 9 to 11 years	2,000—2,400
Children, 5 to 8 years	1,600—1,900

The semiannual dental examinations, coming, as they do, with equal regularity during the Christmas recess and summer vacation, are looked on as a happy coincidence by the children. Their holiday would seem incomplete were the dental examinations taken out of their scheduled program.

The visit to the dentist's office is an even more important occasion in the lives of these children. Because of the plan of assignment, one and the same child may come to the office of the same dentist for a period of six or eight years. As the work needed is mostly either prophylaxis or the filling of some small cavities, there is no necessity for painful and drawn out procedures or discomfort. The time consumed is not longer than thirty minutes on the average for each filling, and never more than twenty-five minutes for prophylaxis. There is no occasion for fear or excitement on the part of the little patient. The repeated visits to the office develop an attachment between the child and the dentist, and create a feeling of implicit faith in the operator, making the service pleasant for both.

This habit of going to the dentist regularly becomes second nature with these children, and as they grow up and leave the institution, they take away with them not only clean, healthy and beautiful teeth, but also the realization of the importance of good teeth, and a knowledge as to how to care for them.

CONCLUSION

As demonstrated by the tables, the majority of fillings required by these children are in cavities showing little depth. Only an insignificant percentage of teeth require pulp treatment, and that only in children who, on admission to the orphanage, have exposed pulps. This gives a good idea of the amount of tooth structure that can be saved by early operative care. It is by no means the easiest method, but, for the present at least, it is the safest and most dependable one.

While a great deal of admirable work has been done in the past decade in an attempt to prevent dental caries by nutritional methods, the point has not been reached as yet by researchers in this field where the profession could be given something definite to work with. The beneficent effects on bones and teeth of vitamin D introduced through a modified diet or through the use of cod liver oil and viosterol has been repeatedly pointed out, and has received much attention. This is indicated by the wide distribution enjoyed by these products. But the

effectiveness of these agents and remedies in the arrest of the carious process has not yet been fully demonstrated. Many are skeptical regarding the possibility of stopping the process of caries in the enamel by the use of certain vitamins. For want of more convincing proof, the statements of those who maintain that they have the nutritional control of caries virtually in their own hands continue to be treated lightly. A theory or method that does not lend itself to general use and is effective only in the hands of its discoverer cannot be considered of material value and cannot have much importance attached to it. As yet, the solution of the phenomenon of dental caries has not been arrived at. When an effective method of either building immune teeth or charging the saliva with immunizing elements is offered, it will be eagerly absorbed and put into practice. The discoverer of a chemicobiologic method of curbing dental caries which can be employed successfully by the average practitioner of dentistry will, indeed, be a real benefactor of mankind. He will have perpetuated his name as did Jenner, Behring, Roentgen and Black, when they gave humanity the benefit of vaccination, diphtheria antitoxin, the roentgen-rays and "extension for prevention" in a manner which made universal application possible.

Until that time arrives, the profession has no stronger and more effective weapon for the combat of dental diseases and their resultant complications than the detection of caries in its incipient stages, its thorough eradication and proper preparation and filling of tooth cavities.

SCIENTIFIC FEEDING OF CHILDREN*

By LYDIA J. ROBERTS, Chicago, Ill.

IF there is any one thing that research in the field of nutrition has demonstrated during the last few years, it is that the nutrition of any one part of the body cannot be considered as apart from the nutrition of the whole. It is true that certain tissues and organs require different proportions of the several food constituents, and a shortage of any one of these will have a more pronounced effect on some organs than on others. Thus, a deficit of iron shows up most strikingly in the blood; of calcium or vitamin D, in the bones and teeth, and of vitamin A, in the epithelial tissues lining the body organs.

Nevertheless, all body cells are fed from the same blood stream and, in general, may be said to require all of the dietary essentials, even if in varying amounts. We cannot therefore be sure that we are supplying the specific needs of any one part of the body unless we also provide sufficient nutrients for all other parts as well. Thus, we cannot consider the nutrition of the teeth in a limited way as if they were independent structures, but must think of their nutrition

*From the University of Chicago, Department of Home Economics.

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 8, 1933.

TABLE 1.—FOOD REQUIREMENTS OF A PRESCHOOL CHILD IN TERMS OF COMMON FOODS

Foods to Insure Protein, Minerals and Vitamins		Calories	Protein	Calcium	Phosphorus	Iron	Vitamin Units*				
							A	B	G	C	D
		1,500	50	1.00	1.20	0.0075	3,000+			15	240
1. Milk,	1 quart	672	32.0	1.17	0.90	0.0024	2,000	110	400	?	Some definite amounts
2. Egg,	1 medium	75	6.8	0.04	0.09	0.0015	1,000	+	70	.....	
3. Cod liver oil, 10D,	1 teaspoon	30	.....	.....	.....	.....	800	.....	.....	.....	530
4. Vegetables,	2 servings									Not depended on for C if cooked	
e.g., beets,	½ cup	35	1.2	0.02	0.03	0.0006	15	+	15		.....
cabbage,	½ cup	25	1.3	0.03	0.02	0.0004	25	+	40		.....
5. Fruits, e.g.,	2 servings										
apple,	1 medium	80	0.5	0.01	0.02	0.0005	70	+	25	.....	.....
orange,	1 medium	80	1.2	0.07	0.04	0.0008	100	+	30	50+	.....
6. Whole cereal,	1 serving	100	4.0	.....	0.10	0.0010	.....	+	+	.....	.....
Total from these foods		1,097	47.0	1.34	1.20	0.0072	4,010	110+	580+	50+	530
Proportion of needs covered		Two-thirds	Probably all	All	All	Probably all	All generously	Probably all, some doubt adequacy in B		All	All
Remainder of calories as desired.											
Potato,	1 small	75	2.0	.....	0.05	0.0008	40	.....	20	.....	.....
Meat,	1 small serving	75	10.0	.....	0.11	0.0012	10	.....	50	.....	.....
Bread, Flour, Cereals	Equal to 3 medium slices of bread	200	7.0	.....	0.07	0.0007	10	.....	.....	.....	.....
Butter,	1 tablespoon	100	.....	.....	.....	.....	700	.....	.....	.....	Some
Sugar,	1 tablespoon	50	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total for entire diet		1,597	66.0	1.34	1.43	0.0099	4770	110+	650	50+	530

Comment: All requirements generously covered unless possibly for vitamin B. Some authorities believe a potent source of this, as yeast, wheat germ, or any one of the numerous prepared products, should be added.

*The allowances for vitamins A and C are those given in Rose's "Laboratory Handbook for Dietetics," third edition, p. 28. The only quantitative allowances for B and G is Rose's estimate of 900 units for the undifferentiated B (B and G), for an adult. This cannot be interpreted in terms of the separate vitamins. Values for vitamins A, C and G are taken from Tables 47, 48, and 49 in Sherman's "Chemistry of Food and Nutrition," fourth edition. Values for B, apart from G, are not available; hence, sources are indicated only by the plus sign. The B value for milk is taken from: MacLeod, F., et al.: "Vitamin A, B (B_1, and G (B_2) Content of Milk Throughout Year," J. Dairy Sc., 15:14, 1932.

The amount of D required seems to depend on its source. The allowance of 240 units is that given by Hess, A. F., and Lewis, J. M. (J. A. M. A., 99:647 [Aug. 20], 1932) as the protective amount when supplied by cod liver oil. If a standard cod liver oil were used, approximately two teaspoons would be needed to meet the requirement.

in connection with the nutrition of the whole organism.

It is for these reasons that I have chosen, in the present paper, to deal not with the limited problem of nutrition and teeth, but rather with the larger one of nutrition and the physical well-being of the child. To this end, I shall first outline the requirements for adequate nutrition in childhood as far as we now understand them, and shall then present some evidence from human experimentation to show that it really does make a difference whether children are thus fed.

merely present these standards as at present accepted in common usage, and shall then translate them into terms of every day foods.

For the sake of simplicity, let us consider first the requirements of the preschool child, and then later indicate what modifications are needed for other periods of life. In Table 1, the needs of the body of the preschool child are presented in terms of quantities of the various constituents that must be provided: calories, protein, calcium, phosphorus, iron and the vitamins A, B, C, D and G. Other inorganic salts are also needed, but since they will usually be taken care of if these specific needs are met, they are not included here. The requirements for the several vitamins cannot as yet be stated with any degree of exactness in quantitative terms. The amounts suggested in the table are proposed by Rose[1]

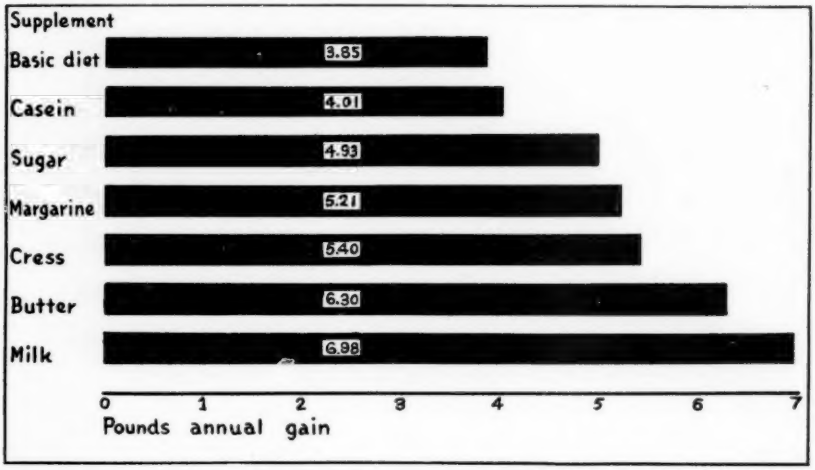

Fig. 1.—Annual gains of boys on various supplements. (Mann's study of English boys.)

AN ADEQUATE DIET FOR CHILDHOOD

First, then, what is an adequate diet for childhood? What should a growing child be fed in order that he may grow normally and develop a sound, healthy body in all respects, including a sound set of well-formed teeth? Space does not permit me to describe here the methods by which these requirements have been determined nor to point out the gaps that still exist in our knowledge. I shall

1. Rose, Mary S.: Laboratory Handbook for Dietetics, New York: Macmillan Company, 1932, p. 28.

as tentative minimum allowances until actual requirements are more definitely determined. Even though these as well as other standards suggested in the table are based on inadequate exact experimental data, they may be accepted as reasonably safe for use until more valid ones are available.

Such a statement of the needs of a child in terms of necessary food constituents is of little value in the practical feeding of children until it is translated into quantities of actual foodstuffs. Our problem then is: With so large a variety of foods from which to select, which shall we choose, and how shall we combine them in order to be certain that all these bodily requirements are fully met? In answering this question, it should be stated at the outset that there are innumerable food combinations possible that would fulfil all these food requirements. Indeed, if a person were to select a reasonably varied diet solely from natural foodstuffs, the chances are great that he would have a fairly adequate diet even without any knowledge of food values or any deliberate planning.

This is true for the reason that all foodstuffs as produced by nature—eggs, milk, grains, potatoes, vegetables, fruits, nuts—are many-sided foods; that is, they contain a mixture of many of the dietary essentials. Almost any combination of such foods, then, eaten in sufficient amounts, would yield a fair proportion of most if not all of the necessary food elements. This explains why the peasant

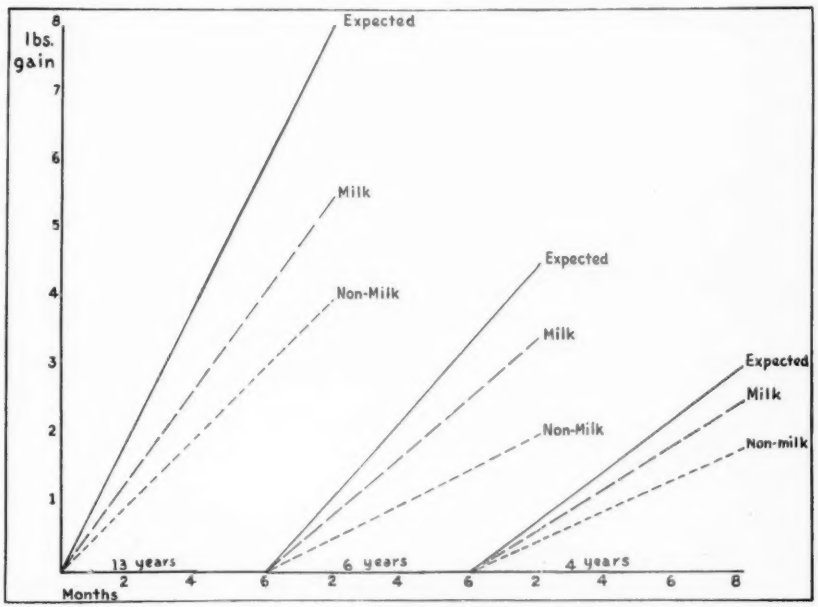

Fig. 2.—Comparison of annual gains of children of 13, 6 and 4 years of age with and without milk supplement and in relation to "expected" gain. (Orr, Leighton and Clark's study.)

people of almost every racial group have developed a diet adequate for the production of a vigorous, well-nourished race.

When the problem is complicated as it is under present-day conditions, with a large array of refined foods—highly milled cereals, sweets, fats and innumerable patent products—selection of food can no longer safely be left to chance, for a one-sided, deficient diet would commonly be the outcome. This does not mean that the modern mother must have a detailed knowledge of food values, nor that she must add up the dietary constituents furnished by every meal to be sure that the day's quota of each is being met. A simpler and more satisfactory plan is for her to utilize a rule-of-thumb plan of feeding, expressed in terms of certain foods or food groups to be used daily in order to insure that all the specific requirements are well supplied. If such a list has been worked out by a person thoroughly familiar with both food values and with the food needs of children, its consistent use will insure adequacy and yet allow much freedom for variety and individual choice in the remainder of the diet. Let us, then, examine one such food list commonly used by nutritionists in order to determine what each of the foods contributes and whether the entire list actually does meet the needs of the preschool child.

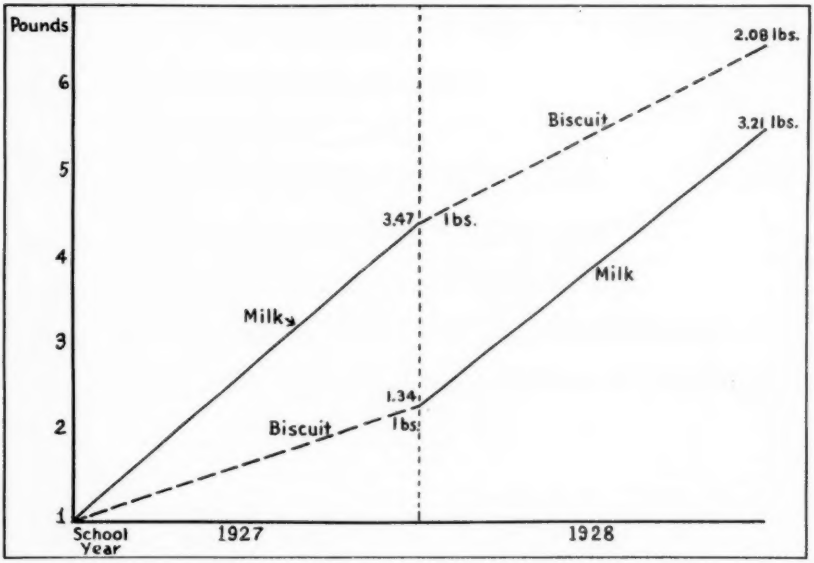

Fig. 3.—Effect of reversing milk and biscuit supplements in 8-year-old children in the study of Orr, Leighton and Clark.

Let us put into the diet first the quart of milk so nearly universally advised for children. It is seen in Table 1 that milk has made a contribution to every food need. It has furnished about half of the calories, two-thirds or more of the protein and phosphorus and appreciable amounts of iron and vitamins, and it has

completely met the needs for calcium. It may also have entirely fulfilled the need for several other constituents, especially for vitamins A and G; but since we are not quite so sure of this, it seems desirable to provide additional amounts for safety. It is easily evident from this table why milk is considered so valuable a food and a good basis on which to build the diet.

An egg a day is also included in our food formula, and the reasons for this are likewise obvious. Egg supplements

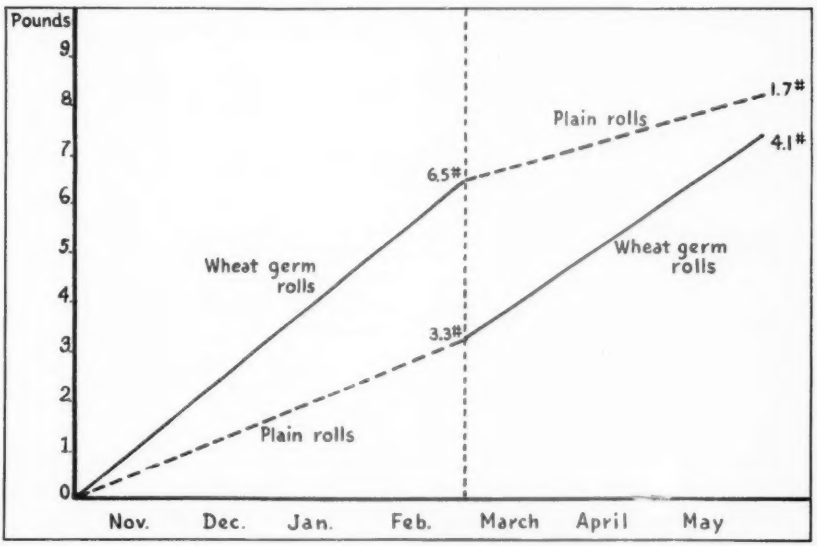

Fig. 4.—Effect of adding wheat germ to diet of California school children. (Morgan's study.)

milk in several important ways, especially in protein, phosphorus, iron and vitamins A, B, G and D. Indeed, there is probably no other food which taken in such small quantities makes a greater contribution to the diet. It is worthy of note, furthermore, that eggs are practically the only food normally included in the diet that provide significant amounts of vitamin D. It is indeed believed by some workers that if it could be a certainty that the eggs were produced under such conditions as to insure their maximum potency in vitamin D, they alone could be relied on to supply protective amounts of this factor. Since it is impossible to be assured of this, it is safer to assume that some other source of D should also be included. We have therefore added one teaspoon of cod-liver oil further to safeguard the diet in this respect. This is probably not needed in the summer months when vitamin D can be supplied by sunshine. (Many authorities give two teaspoons or even more of cod liver oil, at least in infancy. Others believe that one teaspoonful taken regularly is amply sufficient for protection. Larger amounts are needed to cure rickets.)

Vegetables and fruits are next on our list. Although individual foods in each of these groups differ markedly in their content of the various food materials, they are roughly similar, and in order to

allow all the variety possible in the choice of these, our rule is usually expressed as "two servings each of fruits and vegetables daily, at least one of these being either orange or tomato or some other known rich source of vitamin C." In the table, beets and cabbage have been used for the two vegetables (two servings of the same vegetable would be equally good) and applesauce and orange juice for the two fruits, the latter being chosen as the specific antiscorbutic. These represent neither the best nor the poorest choice that could have been made in conformity with our rule, but merely an average one such as might be chosen by the usual housewife.

It is observed that together these four servings of vegetables and fruits make significant contributions to the iron and the vitamin content of the diet, these additions being sufficient to insure probable adequacy in the case of vitamins C and G; and some authorities believe also for vitamin B. Since there are other authorities who doubt this, it seems wiser to provide at least one other potent source of this vitamin. The addition of at least one generous serving of a whole cereal which contains the embryo not only fortifies the diet somewhat in vitamin B, but also in iron, phosphorus and protein.

We find then that the inclusion of this specific list of foods—one quart of milk, one egg, two servings each of fruits and vegetables, one of them orange or tomato, one serving of whole cereal, and one teaspoon of cod-liver oil—fulfills the minimum requirements for the preschool child save for calories and protein and possibly for small amounts of one or two other constituents. The energy need will be met by other foods that the child will normally eat to satisfy his appetite—meat, potatoes, bread, butter and desserts—and since these also furnish some protein and other dietary essentials, the adequacy of the diet will be reasonably well assured.

Including these specific foods routinely in the diet should be a relatively easy matter in the average American home of moderate economic level, and should leave opportunity for all the variety desired in respect to types of meals, choice of foods and methods of preparation. In fact, the usual parent presented with such a list would probably reply, "But that is exactly the way I am now feeding my child." An actual check-up on the diets of the children would in many cases reveal that this is the way the parents *plan* to feed their children, but that the diets as eaten all too frequently fail to conform to the plan. The egg a day turns out to be an egg two or three times a week, the milk usually falls short of a quart, the vegetable servings are small and the cod-liver oil is frequently forgotten. As will be shown later, such omissions are sufficient to make all the difference between passable and optimum nutrition. It is never safe, then, to assume that such a diet is being fed unless an actual daily record kept over several weeks has demonstrated this to be the case.

Fortunately, this same food plan requires slight if any adaptation to make it suitable for other ages as well. The same quantity of milk and eggs, with somewhat larger portions of fruits and vegetables, together with the larger amounts of other foods naturally consumed by older children, will amply meet their increased requirements throughout the growth period. The adult may possibly reduce his milk allowance to a pint if desired, but the other rules should still hold. In pregnancy, when the needs of the growing fetus as well as those of the mother must be met, the diet as outlined here for the prechool child should again be used, together with sufficient other foods to meet

TABLE 2.—ADEQUATE LOW-COST DIET CONSISTING OF A FEW SIMPLE FOODS

Requirements	Calories	Protein	Calcium	Phosphorus	Iron	Vitamin Units				
						A	B	G	C	D
	1,500	50	1.0	1.2	0.0075	3,000	+	+	15	240
Foods and Amounts										
Milk, 1 quart	672	32.0	1.17	0.90	0.0024	2000	110	400	?	Small amounts
Whole cereal	600	24.0	.....	0.60	0.0060	.....	++	+	.....	.....
Chopped cabbage, raw, ½ cup	25	1.3	0.03	0.02	0.0004	25	+	40	56	.....
Cabbage, cooked, ½ cup	25	1.3	0.03	0.02	0.0004	25	+	40	.....	.....
Cod liver oil,* 2 tsp.	60	.....	.....	.....	.....	1600	.....	.....	.....	240
Fat, 2 tsp.	200	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals	1,582	58.6	1.23	1.54	0.0092	3,650	110	480+	56	240

*Standard cod liver oil.

the increased energy demands. In brief, then, this simple rule-of-thumb formula as here outlined can well serve as the foundation of an adequate diet at all stages of child development, from prenatal life through adolescence, and with slight if any modifications even in adult life.

This one simple formula having been stressed, it should be again emphasized that this is merely one method of assuring dietary adequacy which is probably applicable to a majority of American homes, but that it is by no means the only one. As already pointed out, innumerable other combinations could be made that would measure up to the same standards. Space will not permit the inclusion of illustrations of these. In view of the present interest in low cost diets, it is pertinent to include one very simple, inexpensive diet of this type. (Table 2.) This diet consists of only a few natural foodstuffs—milk, whole wheat (or other whole cereal) and cabbage. These foods are chosen to supplement each other's deficiencies, and although perhaps uninteresting and monotonous, the combination is generously adequate (if vitamin D is provided by cod-liver oil in the winter months), and is one on which good nutrition could if necessary be indefinitely maintained. For the sake of palatability, a more varied diet of the type first presented would, of course, be more desirable.

In using such a food formula, it should be further emphasized that every food in the list is included for a specific purpose, and that no one of them should be omitted without assurance that the same constituents are supplied in other ways. Such substitutions can be safely made only by a person with a knowledge of both food needs and food values. Without this knowledge, the safest plan is to choose

some such food formula as has been described and which has been worked out by a qualified person as suitable to the community or group concerned, and then to follow it implicitly.

EVIDENCE THAT AN IMPROVED DIETARY DOES EFFECT IMPROVED NUTRITION

But does it really make any great difference whether children are reared on such an adequate diet? In spite of the positive evidence derived from animal experimentation in the last few decades, this question is still being raised by parents and others concerned in the welfare of children. They will accept without question the evidence that seemingly slight changes in the diet of the rat, the dog or the guinea-pig may make a profound difference in the rate of growth, the ultimate size, the susceptibility to infection and the length of life of the animals concerned. They will then turn around and look at their own children and deny that nutrition could possibly have had anything to do with their poor teeth, their faulty growth and their undersized misshapen bodies. They will grant you of course that a child must have food in order to grow, but if he manages to survive and to attain something of normal proportions, they will present him as proof that your diet theories do not apply to him.

There has been accumulating in recent years evidence from human as well as from animal experimentation that there is a wide difference between a diet that will keep a child alive and allow him to grow into an average individual and one that will produce optimum physical development. It is my purpose to assemble here a few of these human studies that demonstrate this fact.

I shall present first a number of studies to show that so-called adequate growth in children may be accelerated by an improved dietary. Most notable of the studies of this type are two large-scale feeding experiments in England and in Scotland. In one of these, Corry Mann studied in a colony of 350 boys housed on the cottage system the effect of making certain additions to the usual diet over a period of two years.[2] One cottage of boys was kept on the usual diet as controls. To the diets of each of four other groups were added approximately 336 calories. In one, this was given as a pint of milk; in the others, as sugar, margarine and butter, respectively. A fifth group was given an amount of casein equal to the quantity supplied by the pint of milk, and a sixth group was given watercress. These supplements were chosen with the view to determining whether calories, protein or vitamins were most lacking in the usual house diets.

The most significant findings of this study are depicted in Figure 1, which shows the average growth in weight of each of these seven groups, together with the expected gain during this period as given in standard tables of growth. It is seen that the curves of growth rise progressively, one above the other in order of supplement as follows: basic, casein, sugar, margarine, watercress, butter, milk. The greatest acceleration was thus produced by the addition of 1 pint of milk, since, by its use, an annual gain of 3.85 pounds and 1.84 inches on the usual house diet was increased to 6.98 pounds and 2.63 inches. It is of further significance that any addition to the usual diet produced some improvement. Even casein, which supplied additional protein, and sugar and margarine, which added only calories, resulted in gains somewhat in

2. Mann, H. C.: Diets for Boys During School Age, Medical Research Council Special Report Series, No. 105, London: His Majesty's Stationers, 1926.

excess of those on the basic diet, while watercress, which furnished mineral salts and certain vitamins, and butter, which added both calories and vitamin A, produced gains only slightly below those of the milk supplement. It would appear, therefore, that the usual diet fed in this institution was low in practically every essential dietary constituent: calories, protein, vitamins and calcium, and doubtless in other inorganic salts. Since milk supplies most of these essentials, it is not surprising that it produced the best gains. It is worthy of note, moreover, that even this best supplement, milk, did not bring the annual gains up to the expected rate for these years. This is not surprising, for the diets still fell far short of meeting our accepted dietary requirements. It would have been of special interest, therefore, if one cottage could have been furnished all such supplements as would be required to make the diet a completely adequate one, such as that outlined in the diet form presented in the preceding section and the effects on growth observed.

These results, it may be objected, were obtained in an institution, where diets may be expected to be inadequate. The same type acceleration of growth has been obtained in children in their own homes, in this as well as in other countries, and in various economic groups. Shortly after Mann had reported his study on institution children, Orr, Leighton and Clark carried out a similar experiment over a period of two years with 1,500 school children in seven cities and towns in England and Scotland.[3] The supplements in this case, given at school, consisted of whole milk, separated milk and biscuit, respectively, for each of three groups, while a fourth group was kept as controls. It was found that the gains of the biscuit group differed little from that of the controls, and that those of the two milk groups were so nearly identical that the findings of the study were considered in but two groups, the "milk" and "nonmilk."

The results essentially duplicated those of Corry Mann. In every city, and in practically every age group, the gains made by the milk-fed children exceeded those of the nonmilk groups in both height and weight. (Fig. 2.) In order to make sure that the differences were not due to chance selection of children, the second year some of the groups were reversed, the separated milk group now receiving biscuit and the biscuit group being given the separated milk supplement. The results, as shown in Figure 3 for one typical group, were such as to leave no doubt as to the improvement effected by the milk supplement, for the groups now changed places in respect to their annual gains, "the former milk group now receiving biscuit fell to the biscuit standard, while the former 'control' group now receiving milk rose to the milk standard." Again, perhaps the most striking observation in this study is the meager gain of these children on all diets. Even during the second year when the gains were greatest, the average weight increments of even the milk-fed groups did not reach the expected rate and those of the non-milk groups were far below them. (Fig. 3.) In both these English studies, moreover, the milk-fed children were strikingly superior as judged by other outward signs. Indeed, the physicians making the examinations could almost without fail pick out these children by their sleek, well-fed ap-

3. Orr, J. B.: Milk Consumption and Growth of School Children, Lancet, 1:202 (Jan. 28) 1928. Leighton, G., and Clark, M. L.: Milk Consumption and the Growth of School Children, Lancet, 1:40 (Jan. 5) 1929.

pearance, their smooth, glossy hair, and their abundance of animal spirits.

Similar studies have also been made in our country. At the University of California, Alice Fay Morgan has for a number of years been testing the effects of dietary supplements on the growth of California children in various economic groups. At various times, she has tested the effect of adding milk, figs, orange, wheat germ and mere calories in the form of a sweet sandwich. Suffice it to say here that, as in the English studies, any addition to the usual diet has resulted in improved growth. In some cases, the milk supplement produced the best gains; in some, oranges caused even greater acceleration than did milk, and, in some, the mere addition of calories caused almost as good increases as the other supplements. The result depended on the community in which the experiment was carried out, and obviously was determined by what dietary essentials were most deficient in the home diets.

The results of one of these studies are shown in Figure 4. In this case, the effect of adding wheat germ, a rich source of vitamin B, to the diet was tested in a school lunch room in Berkeley.[4] Two groups of undernourished children were given two rolls daily as a part of their regular noonday lunch. One group received ordinary white rolls, the other rolls in which a definite amount of wheat germ had been incorporated. As observed in Figure 4, the group receiving the wheat germ rolls gained at three times as rapid a rate as the group receiving plain rolls. Again, to make certain the results were not due to chance selection, after from fifteen to eighteen weeks, the groups were reversed, the ones receiving the wheat germ rolls now having plain ones, and the plain roll group now receiving the ones containing wheat germ. The outcome was that the gains were now sharply reversed, the group receiving the wheat germ again excelling the plain roll group to a significant degree. The difference in growth in each test thus appeared to be due to the quantity of vitamin B in the diet.

A special aspect of this question of improved growth through improved diet is the problem of the underweight child who seemingly cannot gain, no matter how much he eats or how hard he and his parents appear to try to increase his weight. I say "seemingly cannot gain" because ample evidence has been advanced to show this claim to be unfounded, at least in the cases studied. In a detailed metabolism study made by Chi Che Wang of sixty underweight children, not one child who stayed under supervision for two weeks or more failed to gain, and those who stayed longer all gained far in excess of the expected rate, some of them at a really spectacular one.[5] Yet most of these children had been brought for the study because of the claim of their parents or the nutrition workers that they could not gain.

A study from our own laboratory on ten such nongaining children in a preventorium showed similar results.[6] The diets of this group were already qualitatively adequate, the protein, minerals and vitamins being far more generously supplied than is common in children's diets. By special supervision to increase the

4. Morgan, Alice F., and Barry, M. M.: Increased Growth Through Use of Wheat Germ, Am. J. Dis. Child., 39:935 (May) 1928.

5. Wang, C. C., et al.: Metabolism of Undernourished Children, Am. J. Dis. Child., 32:62 (July) 1926.

6. Hord, N., and Roberts, L. J.: Dietary and Hygienic Control of Ten Nongaining Preventorium Children, J. Am. Diet. A., 4, 47 (Sept.) 1928.

caloric intake, a group gain of 4.75 pounds a month was changed to one of 22.25 pounds for a similar period, a fivefold increase over the previous rate. In keeping with these are the reports of both Dr. Sauer,[7] of Evanston, Ill., and Dr. Seham,[8] of Minneapolis, on the basis of clinical studies of large numbers of undernourished children, that practically all such children can gain at a satisfactory rate when put on an optimum diet and health regime.

Improvement in nutrition on an improved dietary is also revealed in other physical signs. One of the most striking of these is the condition of the teeth. One outstanding demonstration of this is found in the large scale community study made by Davies of the food habits of children in relation to their physical status, in two rural towns in Massachusetts, one a dairying, the other a nondairying, community.[9] The significant difference in the diets found in these two towns are shown in Table 2. It will be noted that except in the case of fruits and vegetables, the percentage of children using the important foods listed in our food plan, in approximately adequate amounts, is significantly higher in the dairying than in the nondairying community, 67 as against 16 per cent for milk; 89 as against 58 per cent for eggs, and 55 as against 32 per cent having high total diet scores. The physical findings, moreover, as far as they were obtained, are in keeping with the dietary findings, the condition of the children in the nondairying community being generally less satisfactory than in the dairying one. (Table 3.) The percentage of children 10 per cent or more below the average weight for their height and age was 28 for the nondairying and 11 for the dairying town. The teeth conditions, though poor in both communities, was decidedly less satisfactory in the former community, twice as many children having five or more unfilled cavities (22 per cent as against 11 per cent) and almost half of the children (46 per cent) having all four first permanent molars carious or extracted as against 18 per cent in the dairying community. Though other unknown factors were undoubtedly in part responsible for these differences, it seems obvious that diet must have played an important rôle.

More specific studies have demonstrated that dental caries may actually be arrested in children by merely fortifying the dietary with essential foods. The most clear-cut illustrations of this in our own country are the experiments of Bunting and collaborators at Ann Arbor,[10] and of Boyd, Drain and Nelson at Iowa City.[11] These studies are well-known to all dentists, and are recalled here merely to emphasize the adequacy of the simple diet form herein outlined, not only for optimum growth but also for the rôle it may play in the development and preservation of the teeth. In Bunting's study, it will be recalled, five groups of children treated with various dietary and therapeutic measures were followed up for approxi-

7. Sauer, L. W.: Malnourished Child; An Individual Intensive Method of Treatment, J. A. M. A., 89:931 (Sept. 17) 1927.

8. Seham, Max, and Seham, Grete: Relation Between Malnutrition and Nervousness, Am. J. Dis. Child., 37:1 (Jan.) 1929. Seham, Max: Am. J. Dis. Child., 36:639 (Sept.) 1928.

9. Davies, E.: Food Consumption of Rural School Children in Relation to Their Health, Massachusetts Agricultural Experiment Station Bull. No. 241, 1928.

10. Bunting, R. W., et al.: Problem of Dental Caries, Am. J. Dis. Child., 40:536 (Sept.) 1930.

11. Boyd, J. D.; Drain, C. L., and Nelson, Martha V.: Dietary Control of Dental Caries, Am. J. Dis. Child., 38:721 (Oct.) 1929.

mately a year for the effect of their diets on the activity of dental caries. Two groups were given a good diet plus a mouth wash; one group a good diet alone, and one the mouth wash alone; while the fifth group was kept as a control. Briefly stated, the results showed that, in all groups of children in which dietary measures were employed, active dental caries was almost completely arrested regardless of whether or not the mouth wash was used; while in the control group and the one using mouth wash only, there was not only a marked evidence of active caries but also a greater incidence than at the outset.

TABLE 3.—PERCENTAGE OF CHILDREN HAVING SPECIFIED ITEMS OF DIET IN TWO RURAL COMMUNITIES IN MASSACHUSETTS*

Dietary Items	Non-dairying Community	Dairying Community
1 quart of milk	16	67
Vegetables	51	26
Fruits	54	18
Whole cereal	3	8
Eggs	58	89
High total score (60 or better)	32	55

*Adapted from Davies.

The Iowa workers likewise found a striking arrest in dental caries whenever the diet was fortified with all the essential food materials. A significant feature of this study was the fact that diets differing widely in the character of foods used were equally effective. The diabetic diet with its high proportion of fat, and low of carbohydrate, but with generous quantities of fruits, vegetables, cream and eggs; the diet for celiac disease, which was low in fat and high in simple sugars and protein; and the normal preschool diet, which was well-balanced in protein, fat and carbohydrate, as well as other constituents—all produced the same results, namely, a change of formerly soft dentin to one of stony hardness after a few months on the dietary regime. The explanation is that these diets were similar in that they all contained an abundance of the foods that supply all the bodily requirements, especially minerals and the vitamins. Of special interest in this connection is the arrest of caries in the preschool group. At the beginning of the study, the parents had insisted that the children were already being given all of the specified foods, but when actual records were kept, this was found not to be the case. Moreover, when the diets were supervised to insure that these foods really were included every day, a striking arrest in dental caries occurred in these children.

TABLE 4.—COMPARISON OF PHYSICAL STATUS OF CHILDREN IN TWO RURAL COMMUNITIES IN MASSACHUSETTS*

Condition of Children	Percentage of Children Having Specified Condition	
	Non-dairying Community	Dairying Community
Underweight 10% or more	28	11
Unfilled cavities in permanent teeth:		
None	17	35
Five or more	22	11
All four first permanent molars carious or extracted	46	18

*Adapted from Davies.

The point worthy of emphasis here is that the foods in the diets used by both of these groups of workers were practically the same as those contained in the food form outlined in this discussion. The results attained in both

these studies, then, would seem to argue for the relative safety of using this simple formula as a practical method of assuring an adequate diet in situations in which it is suited to the dietary customs and the available food supply. Further evidence could be produced in the records of many other children reared on this same dietary regime who have shown superior growth and development.

The simplicity of such a feeding plan should commend itself to every parent. Unfortunately, its very simplicity too often argues against it for many people. The popular tendency is to seek for something heroic and unusual in the way of a dietary plan—a diet which calls for the leaving out of some staple article of food, for not mixing certain foods or dietary constituents in a given meal and other unnecessary if not actually harmful deprivations. Indeed, the more unusual, even fantastic, the dietary proposed, the greater the number of followers it will probably have; while the idea that our plain everyday foods—meat and potatoes, milk, eggs and whole cereals, bread and butter and fruit—included regularly in adequate amounts and in palatable form, will provide superior nutrition is only with difficulty, if at all, accepted. Yet these are the facts as demonstrated not only by the experiments reported in this paper but also by numerous others which might be quoted.

The obvious conclusion clearly is that instead of following blindly after every new diet fad that makes its appearance, we should accept rather some simple common-sense dietary made up of ordinary foods available in the community concerned, in such quantities as are recognized by authorities in nutrition to be adequate, and use it faithfully and regularly in the feeding of children. If we could but do this relatively simple task for the children under our guidance continuously throughout their development period, we should reap a rich reward in the way of a greatly improved generation of children and adults. It is safe to say, moreover, that this improvement would be especially marked in respect to the teeth.

FIFTEEN YEARS OF DENTAL RESEARCH AT THE NATIONAL BUREAU OF STANDARDS*

By WILMER SOUDER,† Ph.D., F.A.C.D., Washington, D. C.

THE National Bureau of Standards was first called on for extensive information on standards for dental materials[1] in 1918 and 1919.

SOME TYPICAL STANDARDS

Many members of the dental profession, at that time, were buying amalgam alloys bearing the names of individual men prominent in the profession, the inference being that any product developed or used by these men would be of unusually high quality. Others were influenced by the claims of high silver content, no zinc content, whiteness or similar qualities which the alloy was supposed to possess. Some purchased on the basis of price, feeling that a high price was a guarantee of high quality.

Dental gold alloys were marketed with such descriptions as 750 fine, 22 K, solder *for* 18 K, platinum *color,* etc. Thousands of ounces of gold alloys are sold today under the brand or names of individuals.

Investments, plasters, Keene's cements, etc., were sold under all sorts of names, such as stone heat resisting, true form, lith and other catchy names of no significance, not one of the designations carrying any meaning or guarantee as to the suitability of the product.

If we look at the past and present claims in detail, we find some clever uses of the English language. For example, the clasp alloy is guaranteed to have a platinum *color.* Many nickel alloys have platinum colors; in fact, some alloys without a trace of platinum have colors more nearly platinum than some dental alloys actually having a platinum content. The 750 fine label means 75 per cent precious metal content. Now it is known that a fraction of a per cent of certain elements, such as lead, will render an alloy practically useless for most dental restorations. Similar comments hold for the 22 K and other carat ratings. The designation of "for 18 K" used in selling solders means that the material is recommended for use with some brand of 18 K alloy (usually the same manufacturers) and does not indicate the precious metal content of the solder, its melting range, tendency to tarnish or any one of a number of things the dentist should know.

The alloys (gold and amalgam) sold under the brand or trade name of some prominent dentist who has given his approval of a product may have been good for the time at which they were developed, but with the advent of metallurgy

*Publication approved by the Director of the Bureau of Standards of the U. S. Department of Commerce.

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 8, 1933.

†Chief, Dental Laboratory.

1. Souder, W. H., and Peters, C. G.: D. Cosmos, 62:305-335 (March) 1920. Bur. Stand. Technologic Paper No. 157 (price, 10 cents).

and engineering science in dental factories, there is no longer need for such endorsement (usually given for a consideration). One manufacturer tells me that the prominent dentist whose name appears on the package does not know the formula of the alloy as sold today. Of course, there is no objection to dentists giving a bonus to these prominent men every time they buy, if they wish to do so. In many instances, the manufacturer anticipates a thorough analysis of this phase of salesmanship and will, if requested, supply a brand of equal physical properties without the name of the eminent doctor on the package, and at a cheaper price.

INFORMATION UNCLASSIFIED

These conditions and many others of similar nature were met when we entered the field of dental research about fifteen years ago. We found it impossible to study intelligently the fundamental properties of the dental materials through a study of the literature then available. Our first extensive work took up the fundamental physical and chemical properties of dental gold and amalgam alloys without our seeing at that time a very definite dental application of these properties. So great was the gap between this fundamental research and its dental application that, as late as 1924, in the face of several pages of data, a lengthy report[2] and an outline of the research,[3] a prominent testing expert, speaking in behalf of the manufacturing interests, raised questions[4] as to the need for this research and as to whether anything was being done for the benefit of the profession.

COORDINATION OF RESEARCH AND DENTAL PRACTICE

After eight more years of careful observation, the answer is here and is definite; namely, that the dentist is slowly but plainly asking for definite standards in his materials and the manufacturers are now making alloys to the standards developed as a result of this research. The dentists are asking for amalgam alloys which will expand on setting and they want that expansion to be about 4, 6 or 8 microns per centimeter. Such claims as "high silver content," "freedom from contraction," or "according to recognized standards" are too indefinite for the dentists of 1933. Instead of the white platinum color claim for gold alloys, they want to know whether or not the alloy contains platinum and how much, or whether nickel has been substituted for platinum to give it the platinum color. They want dental investments which expand an appreciable amount when heated to eliminate the wax. They want the cavity in the investment to enlarge so that it will help compensate for the shrinkage of the gold which is soon to fill the cavity.

Hundreds of dentists[5] have followed the research in detail and are orienting their purchases and technics to the highest efficiency. Others are observing these dentists and unconsciously absorbing or blindly adopting their methods. Several dental schools are teaching the subject in greater detail, emphasizing the results of the research. A few schools have installed equipment and are getting vivid pictures of the conditions and possibilities. Enough has been said to prove that

2. Souder, Wilmer: Physical Properties on Dental Materials, J.A.D.A., 12:509-546 (May) 1925.

3. Department of Commerce: Dental Research, J.A.D.A., 11:249-250 (March) 1924.

4. Footnote 2, p. 516.

5. Volland, R. H., and Paffenbarger, G. C.: Cast Gold Inlay Technic as Worked Out in Cooperative Research at National Bureau of Standards and Applied by Group of Practicing Dentists, J.A.D.A., 19:185-205 (Feb.) 1932.

dentists, dental schools and manufacturers have done something about the situation. Most of them have done it willingly. Under the certification plan[6] of the American Dental Association, it is now possible for the dentist to secure high grade supplies for most of his operative work.

COOPERATIVE RESEARCH

I shall now describe in detail the operations and results of our cooperative dental research. Most of you are familiar with the program[7] as conducted for six years with the cooperation of the Weinstein Research Laboratories, and since April, 1928, with the Research Commission of the American Dental Association. These contacts have been most satisfactory to the Bureau of Standards. Personnel and funds for purchases and expenses have been placed at our command; which have enabled us to more than double our normal progress in this work.

If you have read all the reports,[8] covering about 600 pages, on this work, you will gather little new information from the remaining pages of this paper. Perhaps it will be worth your effort to follow the attempt at evaluating the work and to ask yourself what you may do differently as a result of the data set forth in review.

AMALGAM EXPANSION

Tests of amalgam alloys showed certain fundamentals[1] for a satisfactory filling. Some of these had been recognized previously, but were not universally accepted as necessary. I believe that the Bureau first, at least independently, measured the thermal expansion of teeth and amalgam[1] and showed that the expansion (and shrinkage) with temperature change is almost three times as great in the amalgam as in the tooth. This at once gives us the reason[9] that plastic amalgam placed in a tooth will not seal the cavity when both cavity and amalgam are cooled below body temperature, unless, during the hardening process, the amalgam expands slightly and compresses the dentin. This compression of dentin will cause the cavity to follow or close in on the filling when the latter is cooled by cold foods or drinks. The amalgam, if cooled, will shrink about three times as fast as the normal shrinkage of the tooth; hence, the necessity for this follow up of the dentin. This is produced by the crystallization expansion of the amalgam during the setting period. Mathematical considerations indicate that this crystallization expansion should be at least 3 microns per centimeter; that is, 3 parts in 10,000. A few parts above 3, say to 6 or 8, seem to be even more desirable. This definite finding has caused dentists to investigate such statements in the literature as "2 points" expansion (which is meaningless) a "balanced alloy" or "expands 1 part in 20,000" (which is only one-half part in 10,000). Such claims expose a manufacturer to just criticism.

For years after our findings were first announced, amalgams which were known to shrink on hardening or setting were still sold to the profession. A large number of manufacturers did nothing after reading the first report. Your research associate, in 1928, called these facts to your attention in a graphic and statistical

6. Dental Research Fellowship at National Bureau of Standards, J.A.D.A., 20:1040-1042 (June) 1933.

7. Bur. Stand. Res. Paper No. 32 (price, 35 cents).

8. Taylor, N. O., and Paffenbarger, G. C.: Progress Report on Research on Dental Materials (1931), J.A.D.A., 19:405 (March) 1932.

9. Souder, Wilmer: J. D. Res., 7:173-188 (June) 1927.

method.[10] Now, you may find it difficult to purchase a shrinking alloy unless you purchase a nonguaranteed alloy or some of the so-called model alloys. (Many of these model alloys will show expansion.) A remarkable change took place after the 1928 report was published.

CLAIMS OF "POISONING" FROM AMALGAM

Through a series of somewhat tedious laboratory tests[11] we have, we believe, exploded the recurrent claims of poisoning from the mercury in dental amalgams. By showing that mercury in dental amalgams does not vaporize in the mouth, that the filling does not wear or dissolve rapidly and that such particles as do wear or dissolve away are present in amounts far below any toxic dose, we have, we believe, shown the absurdity of these claims.

OTHER FEATURES OF AMALGAM

Further amalgam tests showed that all amalgams flow under pressure, but at different rates, and that the dentist may make a wise selection of alloys on the basis of this fact.

The necessity for care by the dentist in triturating his alloy was, I believe, first stressed in our report[1] wherein it was shown that excessive trituration might produce shrinkage of an amalgam. This fact has been confirmed and brought to the attention of the profession under very convincing circumstances.

Leading manufacturers have decided that adequate testing equipment must be provided and there is more to the manufacture of an alloy than melting and filing an ingot of silver, tin, copper and zinc. They have found that the alloy is affected by changes in method of cutting, by differences in the size of particles, by usual, accidental or intentional temperature changes and many other conditions which were formerly ignored by most manufacturers or regarded as of little consequence.

SPECIFICATIONS FOR DENTAL AMALGAM

In 1926, this Bureau, with the cooperation of a number of other agencies, prepared a specification[9] for dental amalgams and gave it to the public. This specification stands unimpeached and as the pioneer in this field. A few slight changes are contemplated which will make it a more rigid specification and guarantee that the highest properties possible will be supplied. These changes have come about by reason of slight improvements made by amalgam manufacturers. Further changes in the specification can be made if additional improvements are made by manufacturers. There are now no data on manufacturers' products to indicate that standards higher than the contemplated revised standards can be met at this time. There will always be differences in "feel" or "working properties" of the different amalgams and the dentist should be free to select an amalgam alloy having such feel or working properties as best suit him, provided the amalgam meets the specifications[12] of the American Dental Association. The amalgam alloy problem is more nearly settled than at any time during the 100 years of its existence. The details whereby this was accomplished are extremely simple. The manufacturer produces and tests his product. If it is satisfactory, he guarantees it. He sends

10. Taylor, N. O.: Mechanical Amalgamation: Progress Report on Research on Dental Materials, J.A.D.A., 16:583-599 (April) 1929.

11. Souder, Wilmer, and Sweeney, W. T.: Is Mercury Poisonous in Dental Amalgam Restoration? D. Cosmos, 73:1145-1152 (Dec.) 1931.

12. Taylor, N. O.: Specification for Dental Amalgam Alloys, J.A.D.A., 17:112-124 (Jan.) 1930

with it a definite technic for its use. The dentist must observe this technic. In the event any difficulty should arise, the alloy can be tested according to the recommended technic, and condemned, or eliminated from further investigation. This also enables the dentist to check up to some extent on the efficiency of his operative procedure. This may sound mechanical or lacking in the personal equation, which is always present in dental work, but must not be confused with or lost in an attempt to inject it into the purely mechanical phases such as percentages of elements, time of mix, flow and expansion of mix, all of which yield the same final results for technics repeated in each detail. The personality of the operator will exhibit itself in cavity design, removal of decay, pressure of amalgam to the cavity walls, contour and design in carving, correctness of contact point, polish of restoration, interproximal space relations and general superiority of the restoration. These personality features can be displayed best with the best alloys.

SHRINKAGE OF GOLD ALLOYS MEASURED

Perhaps the greatest single item contributed to the knowledge of gold alloys and their use is the determination of their shrinkage in casting.[7] The establishment of a value (1.25 per cent) gave clinicians an idea of the compensation which must be made if castings are to be made to size. I give the above-mentioned value as definite in the face of a few claims appearing now and then insisting on values from 1.0 to 1.6 per cent. The accuracy with which the value 1.25 per cent was determined is about 0.1 per cent. Such descriptions of other determinations as are available raise the question as to whether their accuracy can be over 0.2 per cent. These limits, if correctly judged, leave very little evidence of real discrepancy. The further claims for more shrinkage in crown or mesioclusodistal restorations are not convincing and may result from failure to paint the inner surfaces of wax patterns uniformly. Employment of any surface other than a flat mirror surface will introduce errors in determining shrinkage values. Measurements made on "frosted" or matt finish surfaces will tend to indicate greater or lesser shrinkages as they are measured inside or outside of crowns or in similar restorations. Claims for differences in shrinkages of low melting gold alloys or slightly different compositions have been considered but have not been verified in experiments. Mr. Sweeney, of the American Dental Association's research staff, made an effort, about a year ago, at this Bureau, to determine the effect of the shape of the specimen on shrinkage. His work included spherical patterns, dumbbell, conical and spiral patterns, plain rods and rods with a perpendicular plate at each end. Mr. Sweeney used the same precision equipment as was used by Mr. Coleman and also a more simple type. He found no definite change for any of these special designs. Although his findings are not yet published, as they indicated no change was to be made in the value of 1.25 per cent, I give the results to you at this time.

COMPENSATING FOR SHRINKAGE

With a definite shrinkage anticipated, the dentist now sets about to compensate for it. This discovery of shrinkage and compensation[13] was not made first at the Bureau of Standards. The establishment of the value to the degree of accuracy indicated above is claimed for the work of Coleman (later repeated and elaborated by Sweeney) which was done

13 Souder, Wilmer: Selection of Dental Materials, J.A.D.A., 14:192 (Feb.) 1927.

at and under the supervision of the Bureau of Standards.

The important developments following, and made necessary by, the establishment of the shrinkage value have been: the measuring of the expansions of investments,[7] impression compounds,[7] waxes and fusible metal[14] with the purpose of putting into the hands of the dentists methods to be used in compensating for the shrinkage. These data are available and hundreds of dentists[5] have taken the time and given the effort necessary to master their application.

IMPROVED MATERIALS AVAILABLE

Firms are now supplying the above-mentioned accessory materials up to standard. A few years ago, thousands of cans of dental investment were used which gave little if any expansion on heating to temperatures suitable for receiving the molten gold when castings were made. This type of investment gave very little assistance in compensating for the difficulties produced by shrinking gold alloy.[15] Today, it will be found difficult to purchase such poor investments. Something has been done in this field; so might I review the improvements in waxes and compounds.

The gold alloys have received much attention in this research and have shown decided improvements during the last fifteen years. We are now offered many new and improved types. Twelve years ago, we found wrought materials having less than 0.5 per cent elongation! Some cast gold alloys still have less than 1 per cent elongation. This has a very practical significance for you. Such materials are regarded as brittle. They may not be adjusted when made into clasps. They often break during making. Distortion of the clasp by the patient in removing or inserting a partial denture may cause such an alloy to break. A few manufacturers are still having difficulty in making alloys which will show proper elongation when cast. There are several who have no difficulty in producing satisfactory alloys. Fortunately for the profession, there have been a few manufacturers who have consistently produced relatively high grade alloys. These have been sold in competition with inferior grades and, through bitter experience, many dentists have, after much disappointment, or accidentally perhaps, found which alloys are safest and give the least trouble. This discovery may have come after several years of experimenting by the dentist. When the dentist produced a brittle or porous casting, he knew it was not satisfactory, but with all the accessory materials and supplies, such as wax, investment, casting machine and torch, he might not for months suspect the gold alloy of being defective. Without the fundamental work on physical properties by Coleman, the analysis of the meaning of these properties and the setting up of a few tentative specifications, we should still find difficulty in securing satisfactory and uniform gold alloys.

TECHNICS DISSECTED

Discoveries in technics[15] have been no less startling than those in materials. It has been difficult to call attention to the unsafe technics which some operators employ, through incomplete data, developed and offered the profession. Data from the testing laboratory are usually very definite and seldom admit of more than one interpretation. Perhaps we have been overanxious to give to the profession the results of our findings and to

14. Souder, Wilmer: J. D. Res., 10:554 (Oct.) 1930.

15. Taylor, N. O., and Paffenbarger, G. C.: Survey of Current Inlay Casting Technic, J.A.D.A., 17:2058-2081 (Nov.) 1930.

point out some of the indications of our laboratory tests.

It is almost impossible to convince a man that his results are poor because of a defective investment when he feels the fault is in the gold alloy, or vice versa. He has accepted the salesman's claims without question. To him, the scientific laboratory findings are new creatures, they are not overpersuasive and do not fuss if ignored. Our researches have shown the difficulties encountered in attempting to cast into a cold mold. Several methods for compensating for gold shrinkage have been outlined. The simplicity of the wax pattern expansion technic has been emphasized. Thousands of dollars have been saved dentists who could easily have been intrigued into buying expensive wax expansion equipment, complicated casting machines and many other gadgets of frightfully complicated design and of ordinary utility.

TECHNICS COMPUTED AND VERIFIED

Groups of dentists have been shown how to make bad inlays by using technics known to be defective, and these same dentists have been shown how to make good inlays by using technics based on laboratory findings. These men have made computations from data and curves and have satisfied themselves that the data are accurate and applicable in their laboratories. No technic has been advocated as the ideal, but we have rather assisted and encouraged the individual dentist to develop his own technic, feeling that through a careful study of the fundamentals underlying each step, he will not only develop a safe technic but will also be able to impart this technic to others and, in many instances, to diagnose the difficulties of his own or a fellow dentist's practice.

CHANGED CURRICULUM

The educational program has been changed in a few schools. Equipment[16] has been installed to enable students to test dental materials. They are, in these few schools, getting first hand and up to the minute information on dental amalgam alloys. They know which shrink, which flow excessively, the effects of prolonged trituration, etc. They are also testing gold alloys and accessory materials. They have a quantitative idea of degrees of brittleness, hardness, strength, etc., and understand which properties are of major importance in each type of restoration. The investments and waxes are surveyed and proper technics developed.

These experiments are slowly replacing the refining and assaying of ores and scrap; forging, mining and many other operations which the successful dentist will never be called on to perform. Texts on dental metallurgy are dropping the long descriptions of iron smelting and have discovered that gold alloys usually respond in an entirely different manner from that of the iron and steel alloys. The minute details of base metal metallurgy are being replaced by data on dental alloys and accessories. This cooperative research has given to the profession and laboratories test methods and much of the data on dental materials available in the dental metallurgy texts of today.

FOREIGN ACCEPTANCE

Many foreign laboratories and dental organizations have expressed their ap-

16. Taylor, N. O.; Paffenbarger, G. C., and Sweeney, W. T.: Dental Inlay Casting Investments: Physical Properties and Specification, J.A.D.A., 17:2266-2286 (Dec.) 1930. Taylor, N. O.: Progress Report: Research on Dental Materials; Research Program; Cooperation Work on Inlay Casting Technic, J.A.D.A., 18:296 (Feb.) 1931. Souder, Wilmer: Physical Properties of Dental Materials (Some Laboratory Experiments for Dental School), J.A.D.A., 16:1829-1843 (Oct.) 1929.

proval of this research. Students and teachers write to us and visit the laboratory seeking more complete data on the various phases of the work. Foreign schools are incorporating the results in their curriculums.

SAFE STANDARDS

Your Association now has specifications[17] for a number of dental supplies. These are your property. They are for your use and protection. Other materials will be added to the list as fast as the work permits. One now often wonders why minimum requirements and definite standards were not brought forth several years ago. In the use of most of these materials, we meet the personal equation, but in all these, the personal equation is, as previously stated, in addition to the chemical, physical and mechanical properties which we are discussing. The medical expert does not discuss the personal equation of his fever thermometer, his blood pressure equipment or his medicines. Data on these usually cause him to inject his personal ability into the diagnosis and treatment of the case, but his tools and remedies must be up to the standard of the medical profession. We do not need to argue the value of standards in medicine. Your support of the research program at the Bureau of Standards is proof of your interest in the development of this field of dental science. Every man connected with this cooperative research program is anxious to give to the profession the best his abilities will produce. You have not been offered speculative results. If you have followed developments, you have probably discerned a system in the procedure as suggested by the following topical sequence:

1. What properties are essential in a certain dental material?

2. What limits on these properties are desirable for the best dental work?

3. Can the manufacturers produce a material up to these standards and, if so, set up standards and permit manufacturers to certify that their products are up to standard.

This protects the manufacturer from competition with inferior products, but most essential to you is the fact that it enables you to secure the best products without unnecessary expense or delay. Such procedure seems to be safe from the standpoint of the research laboratory, the manufacturer and the dentist, and it will be so to the public as long as the dentist measures up to the standards of his profession.

SUMMARY

Fifteen years of dental research has given:

1. Precision methods and equipment for measuring the physical properties of dental materials.

2. Discoveries and precision values such as (*a*) thermal expansion of teeth and amalgam, (*b*) effects of overtrituration of amalgam, (*c*) casting shrinkage of gold alloys and (*d*) accurate data on practically all restorative materials.

3. Explanation and coordination of research laboratory data in the language of their dental application.

4. Technics built step by step on accessory materials of known properties, using data in a scientific manner.

5. Specifications for most restorative materials.

17. Footnotes 12 and 15. Taylor, N. O.; Paffenbarger, G. C., and Sweeney, W. T.: Specification for Inlay Casting Wax, J.A.D.A., 18:40-52 (Jan.) 1931. Isaacs, Aaron: Mercury for Dental Amalgams, J.A.D.A., 19:54 (Jan.) 1932. Paffenbarger, G. C.; Sweeney, W. T., and Isaacs, Aaron: Wrought Gold Alloys: Physical Properties and Specification, J.A.D.A., 19:2061-2086 (Dec.) 1932.

6. Improved materials with quality up to standard.

7. New and pertinent laboratory exercises for the dental school.

8. Greatly improved dental restorations at no increase in cost, and in some instances at lower cost.

9. Favorable recognition of the work by many foreign countries.

GOLD INLAYS*

By JOHN SCHOLTEN, D.D.S., F.A.C.D., Cedar Rapids, Iowa

THE subject of gold inlays, one of the most interesting phases of dental science, at once intricate and theoretically simple, embraces an important field in the practice of every-day operative dentistry.

Contributions to this subject have been exceedingly numerous during the past two decades. To aid us in obtaining the correct perspective, a brief historic review will probably not be out of place on this double anniversary occasion.

The inlay has been used in the applied arts for many centuries. Dr. Owre[1] has stated that the first authentic specimens date back to 1500 B.C. The cast gold inlay as it is known today is of more recent origin.

An anonymous philosopher has said, "We need to be reminded more than we need to be educated," and it is with this thought in mind that a digest of a satisfactory and dependable inlay technic as developed in the cooperative research at the National Bureau of Standards and applied by a group in actual practice, is here presented.[2]

In May, 1897, B. F. Philbrook, now of Sioux City, and formerly of Dennison, Iowa, presented to the Iowa State Dental Society a paper entitled "Cast Fillings." This paper is recorded in the published transactions of the Iowa State Dental Society for 1896 and 1897.[3] The paper, as far as it has been possible to ascertain, is the first authentic record of the cast

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 8, 1933.

1. Alfred Owre: Thoughts on Gold Inlay, D. Cosmos, 52:317-321 (March) 1910.

2. Taylor, N. O., and Paffenbarger, G. C.: A Survey of Current Inlay Casting Technics, J.A.D.A., 17:2058 (Nov.) 1930. Taylor, N. O.; Paffenbarger, G. C., and Sweeney, W. T.: Dental Inlay Casting Investments: Physical Properties and a Specification, J.A.D.A., 17:2266 (Dec.) 1930. Taylor, N. O.; Paffenbarger, G. C., and Sweeney, W. T.: Specification for Inlay Casting Wax, J.A.D.A., 18:40 (Jan.) 1931. Taylor, N. O.; Paffenbarger, G. C., and Sweeney, W. T.: Specification for Dental Impression Compound, J.A.D.A., 18:53 (Jan.) 1931. Taylor, N. O.; Paffenbarger, G. C., and Sweeney, W. T.: Inlay Casting Golds: Physical Properties and Specifications, J.A.D.A. 19:36 (Jan.) 1932. Volland, R. H., and Paffenbarger, G. C.: Cast Gold Inlay Technic as worked out in the Cooperative Research at the National Bureau of Standards and Applied by Group of Practicing Dentists, J.A.D.A., 19:185 (Feb.) 1932.

3. Tr. Iowa State D. Soc., 1896-1897, pp. 277-278.

inlay process in dentistry. Apparently, the subject matter of the paper did not awaken active interest. No reference to it or comment on it is found in the leading dental journals of the time.

There were many things that militated against Philbrook's ideas being accepted or creating extensive interest at the time when he gave them. First, and perhaps most important, was the fact that the Iowa population in 1897 was essentially a rural one, and not particularly concerned in the nonesthetic appearance of gold. It was probably much easier for the dentist to sell an entire gold crown for the price that he would be obliged to charge for a portion of tooth made of the same metal. Had Philbrook told his original story to a group of dentists in the city of Chicago, I am sure he would have created an intense interest.

A second reason was that, coincidently with Philbrook's announcement, a keen interest was manifested in and an extensive use made of the porcelain inlay by the profession. Complaints of the quality of cements and the difficulty of inlay retention appear in the literature and these probably were factors in retarding the use of the cast metal inlay.

It is conceivable that the next contribution, Taggart's invention, was independent of Philbrook's. It was a rediscovery of the process. Unfortunately for Philbrook's credit, he came too early. He was ahead of the profession. The profession was not ready for him, and his wonderful invention was temporarily lost.

Ten years later, at the time Taggart made his presentation, the dentists of the country had become quite familiar with the technic of porcelain inlays, had experimented extensively with hollow matrix and solder matrix gold inlays and had encountered the many difficulties involved in the making of these restorations. As a result, there had been marked improvement in the quality of cements, and the advantages of the cast gold inlay were readily recognized by the profession and generally accepted by every practitioner. All of this occurred in a comparatively short time.

It was inevitable that the cast gold inlay would be accepted. Not only practitioners but also patients were in readiness for it, and its spread was epidemic. The limit of improvement in the methods employed in the use of the gold or platinum matrix inlay filled with solder scraps or fiber gold had been reached. The field was receptive to a new procedure. No other process that has been brought forth during the past twenty-five years has exerted so profound an influence on the practice of dentistry as the cast gold inlay.

In all fairness, and fully recognizing the genius of Philbrook, it must not be forgotten that it was Taggart who presented the process and stimulated the profession to study and adopt it as a routine procedure.

It is regrettable indeed that Taggart's title to the cast gold inlay procedure is clouded by a process patent, which in principle is generally recognized as being detrimental to progress and unprofessional. Strange as it may seem, Taggart was supported in his contest on the validity and legality of his process patent, and against the dental profession, by many of the leaders of the profession from whom one would expect a different attitude.

The appellate court disagreed with the many representative members of the profession who were supporting the Taggart patent, and the final decision rendered stated in part:

> The testimony establishes that ten years before the date of the patents Philbrook did —by using a low-grade metal—what upon the face of the plaintiff's claims is asserted has never been done in any metal. . . . At the date

of the Philbrook disclosure, 1897, the concept —of using gold in casting—seems to have been present with him. . . . I am therefore of the opinion that Philbrook's disclosure either alone or in conjunction with the other phases of the art prior to 1907 is sufficient to defeat any and all claims based upon a broad concept for making a cast metal inlay filling by resort to what is commonly known as the lost wax process.[4]

It may not be important to the individual dentist to know who deserves the credit for originating any particular method which tends to widen the scope and usefulness of the profession, but it is of the greatest importance to humanity, which the profession serves, that every means be utilized to disseminate and place in the possession of every dentist all new ideas pertaining to dentistry, with all subsequent improvements evolved thereto, without favor or hindrance.

The twenty-year period following the presentation of Taggart's paper to the New York Odontological Society at its anniversary meeting, Jan. 15, 1907, was replete with new technics, one following another in rapid succession.

The history of dentistry shows that the introduction of a new material, a new technic, or a new process of applying an old material has usually induced dentists to aline themselves either as advocates or opponents of such innovations. And the cast gold inlay process experienced the same treatment.

It is significant that, with few notable exceptions, every paper presented on the subject of the cast gold inlay during this period stressed the method, and the writers, again with a few notable exceptions, entirely ignored the physical properties of the materials employed in the manufacture of the inlay.

At times, confusion amounting almost to chaos existed. Van Horn,[5] as early as 1910, stated all who had gone into the question were in unison as to there being a shrinkage of gold from the liquid to the frozen state, but that there was a wide diversity of opinion as to the amount, as well as the manner of controlling or modifying it, and that the object of his paper was to create an impartial discussion to help dentists to arrive at rational conclusions, by logical deductions, in order that some of the existing chaos might be transformed to cosmos.

Men of scientific turn of mind refused to believe that merely maintaining pressure upon a mass of molten gold, after its being forced into a mold and until it had cooled, would prevent the natural shrinkage of the gold. They realized that this shrinkage was a natural phenomenon, which could not be controlled by any casting device or appliance. They logically reasoned that some plan for compensation must be devised.

This constituted one of the major problems when the Research Commission of the American Dental Association established a research fellowship at the National Bureau of Standards. It is an open question whether the profession fully realizes or appreciates the significance and the magnitude of the work relative to the gold inlay and casting process accomplished at the Bureau under the direction of the special Bureau of Standards Committee of the Research Committee of the American Dental Association. The results constitute a monumental achievement and are in keeping with the traditions of the profession; extending its scope of usefulness and making possible a greater service to humanity.

4. Appellate Court Record No. 2943, p. 668.

5. Van Horn, C. S.: Review and Commentary, Including Technique, D. Cosmos, 52:873-881 (Aug.) 1910.

Roy D. Chapin,[6] former Secretary of Commerce, recently said:

The Research Commission of the American Dental Association and the Department of Commerce, through its Bureau of Standards, are now completing the fifth year of an unusual cooperative research. Through this research standards for dental materials are being established, and methods for the most effective utilization of these materials are being developed.

The Board of Dental Examiners requires applicants to meet a definite standard of training and skill. This qualification is necessary and proper but without standard materials and technics the full value of this training and skill can not become available to the public, and the dental profession is keenly cognizant of this fact. The manufacturers of dental materials also have an important part to play in securing better restorations, and it is obvious that materials fully conforming to the standards set up must be available to the dentist if important advances are to be made. Fortunately there is no fundamental conflict of interests between the professional man and the manufacturer, and the Bureau of Standards is so conducting its work that the best interests of both groups are being coordinated and conserved.

In the final analysis the class most vitally concerned with the success of the undertaking is the general public, and every advancement made will inevitably contribute to the benefit of all the people.

The elimination of guesswork and the application of scientific investigation of dental materials is the fork in the road of inlay practice. Col. Messner's[7] admonition is timely:

It is disappointing to know that many dentists do not take advantage of the facts made available by the cooperative scientific investigations carried on at the National Bureau of Standards regarding certain dental materials and their application. It seems almost unbelievable, in the light of our present knowledge, and many publications concerning . . . the proper means to compensate for dimensional changes in casting gold restorations . . . that many dentists still continue to accept inferior materials or use unscientific methods with which they can not possibly hope to acquire good results.

The manufacture of satisfactory inlays, because of the fact that all of the materials used in the process are subject to volumetric change, is, and probably always will remain, an involved process. In addition, the individual practitioner must not overlook his shortcomings and must recognize that the deficiency frequently lies in him, rather than in method or material.

Accurate data covering the physical properties of gold and gold alloys and accessory materials are available. It is for the individual dentist to obtain this information and to apply it in practice.

Maximum results cannot be expected or obtained if consideration is given only to that portion of the inlay technic involving correct laboratory procedure. Cavity preparation and proper manipulation of wax are also of prime importance. No one step in the procedure is more important than another. The step being performed is, at the moment, the most important detail. A trivial defect in cavity preparation may become a discrepancy of magnitude in the cast inlay. A poorly adapted filling in a perfectly prepared cavity will not afford a therapeutic restoration. Failure is invited by placing a well adapted filling in an improperly prepared cavity. A wax pattern distorted on removal from the tooth or abused after its removal insures failure, while the use of an inferior investment material or the misuse of an acceptable one will nullify all efforts which have preceded it.

It is not within the scope of this paper to discuss cavity preparation, except in its relation to and in consideration of correct inlay procedure.

G. V. Black gave the profession the

6. Board of Dental Examiners of District of Columbia, Bull. No. 9, cover page.

7. Board of Dental Examiners of District of Columbia, Bull. No. 9, p. 5.

only system of cavity preparation founded upon demonstrable scientific facts. The modifications necessary to adapt this system to inlay procedure are slight and only of minor detail. Ninety degree angles are found in the perfect cavity preparation which is highly desirable for gold foil and amalgam. It was with gold foil and amalgam in mind that Dr. Black promulgated his principles of cavity preparation. A slight divergence of cavity walls is permissible in the use of the inlay preparations. Such a divergence satisfies the theory of the inlay principle. This divergence is sufficient at 90.5 degrees; and, wherever practical, structure of tooth substance, direction and lines of stress, etc., being considered, not more than 91 degree angles should be employed. Resistance form is decreased in direct ratio to the divergence of the walls. Hopper-shaped cavities and rounded internal angles are not indicated. Therefore, a suitable inlay cavity is not radically different in form from that required for foil or amalgam, and men advocating slice preparations tacitly admit they cannot properly prepare a Black cavity.

It is conceded that it is more difficult to prepare a cavity properly for an inlay than for gold foil or amalgam, and this undoubtedly accounts for at least 50 per cent of our inlay failures. The three outstanding causes are: (1) failure to extend and obliterate susceptible areas; (2) failure to so make the preparation as to permit the removal of the wax pattern without distortion, and (3) failure to extend the margins to permit proper finishing and contour.

To this may be added the result of the use of an ill-advised operative technic such as the employment of stones and disks in finishing the walls and margins. No carpenter or joiner would attempt to produce a uniformly flat surface by the use of a draw knife. He would use a plane. This principle is best applied in cavity preparation by the use of sharp cutting instruments held in a firm grasp and propelled in definite directions. Feel and touch are essential. Sharp cutting instruments are necessary in finishing the walls and margins of a cavity.

Ample retention, sufficient resistance for the inlay and all the requirements of extension for prevention must be met in a correctly prepared cavity.

Prior to 1928, the operator who prepared an ideal cavity and made a good inlay with the technic then available obtained uniform results in his inlay work. This same operator, after acquiring and applying in his practice the results of the scientific investigation of inlay materials at the Bureau, is making better inlays today.

Inlay casting waxes form the link between the operative procedure in the mouth and the laboratory technic. Their physical properties must be understood. The effect of the technic employed must be considered.

The primary requirements of a suitable inlay wax are a minimum amount of flow at open mouth temperature. The maximum flow should take place at a slightly elevated temperature. A wax of this type is sufficiently plastic to permit taking fine impressions without undue heating. The temperature range between the rigid and plastic state does not exceed 8 degrees F. In direct inlay technics, shrinkage of the wax is increased when this temperature range is increased. It is sufficiently rigid at ordinary room temperature to withstand necessary handling without distortion and can be carved without chipping or flaking.

Thermal expansion is another important property of inlay waxes and these various expansion values must be known

if any method of wax expansion is to be intelligently used. The disappointing results obtained by many operators with the various wax expansion technics of the past arose from the fact that expansion calculations were incorrectly made. It was not until definite values for wax expansion were published[6] that attention was directed to the fact that the amount of expansion varies over different temperature ranges.

The production of an acceptable wax pattern in the mouth is perhaps the most difficult and exacting step in the entire procedure. It requires a high degree of skill. Volland[8] states: "I am convinced that a large percentage of ill fitting gold inlays are due to the use of faulty patterns in the inlay's manufacture." He arbitrarily grouped under four headings the factors which account for imperfect wax patterns: (1) faulty cavity preparation; (2) failure to adapt the wax to the cavity walls and margins; (3) failure to maintain that adaptation, and (4) carelessness in handling and treating the pattern after removal from the cavity.

Wax can be tightly adapted to the walls of a correctly prepared cavity. The resistance and retentive form of such a cavity assist materially in maintaining the adaptation of the wax during the carving process. The flat seats and slightly divergent walls of the cavity permit the removal of the pattern without distortion.

If an operator prefers, a matrix may be used in making patterns for two-surface cavities. This may assist in obtaining greater condensation and better adaptation of the wax to the cavity walls and margins. When it is used, it should not be tightly adapted to the tooth, but should permit of a slight flow of wax over the margins.

The introduction of the wax into the cavity and all shaping and carving should be done in such a manner as to adapt the wax and to maintain the adaptation. Especial care should be exercised to prevent the pattern from being moved bodily in the cavity during the carving and finishing. No attempt should be made to cut the wax flush to the margins of the cavity with a sharp bladed instrument. The elasticity in the wax causes it to feed out upon the blade. The contraction following the passing of the blade carries the wax back into the cavity, allowing an enamel margin to remain uncovered. In carving, a small excess is allowed to remain over the margins and is then removed by burnishing or polishing. The contact point is released by the use of "A" sewing silk, which may also be used in removing the excess wax of the proximal portion, passing in an occlusogingival direction with a shaving motion. Ordinary dental floss is too heavy for either of these purposes and is apt to stretch the wax away in the occlusal dovetail.

All chips are removed with water at mouth temperature. Chilling of the pattern with either cold water or compressed air is avoided. Chilling a wax pattern causes excessive contraction toward the point of application, producing a distorted pattern. An acceptable wax does not require chilling. It is fairly rigid at open mouth temperature.

Every wax pattern is finished as though it were to be the completed inlay. It is more difficult to correct form and contour in the gold casting than it is to shape the wax pattern properly; and the latter can be accomplished in less time.

Do not expect to correct errors in cavity preparation by any subsequent treatment of the wax pattern, or harbor the

8. Volland, R. H.: Waxes and Wax Patterns for Cast Gold Inlays, Chicago D. Soc. Bull., 8:7 (Sept. 16) 1927.

delusion that errors in wax patterns will be compensated for by the method, investment materials or technic of casting. It is possible to reproduce any given wax pattern in gold, but this is not the problem. The problem is to make inlays which will fit the cavities for which they are intended.

The wax pattern is removed from the tooth by the aid of a delicate explorer tine, embedded at the most convenient point to permit the wax to be shed directly parallel to the long axis of the tooth. Except where there is an unusual bulk of wax, it is a dangerous practice to embed a sprue in the pattern while in the tooth cavity. The heated sprue softens the wax over a considerable area and the subsequent cooling and contraction result in distortion. Existing undercuts which would be readily detected when an explorer tine is used may escape detection when the wax pattern is "dragged" through them from the cavity by so firm a handle as a sprue.

A wax pattern which can be dislodged from the cavity by a blast of air or a stream of water is ordinarily unsuitable. A properly prepared cavity and a suitably adapted wax pattern will provide sufficient frictional resistance to prevent a pattern from being removed by a stream of air or water. A desirable pattern will exhibit a definite "let go" on removal.

With the pattern lying in the palm of the hand, the sprue can be attached at the most convenient point with little danger of distortion. Immediately after the sprue is attached, the pattern should be washed with a solution of liquid soap applied with a fine camel's hair brush, followed with room temperature water, and dried with a few short blasts of compressed air. Care should be exercised not to bend or distort the fine margins of the pattern by careless use of the brush. Blood and débris, if allowed to dry on a wax pattern, are difficult to remove later.

A wax pattern should be invested immediately, and when it is impossible to do this, it should be protected from sudden changes in temperature.

If the details of wax manipulation and adaptation have been carefully executed up to this point, the pattern will be the exact size of the cavity at mouth temperature. As it cools to room temperature, dimensional changes occur. The amount of this change is dependent on the composition of the wax and the room temperature.

Inlay waxes meeting the specifications of the American Dental Association have an average thermal expansion of approximately 0.02 per cent for each degree (F.) change in temperature in the temperature range employed in the inlay process. Particular attention is directed to the fact that these values vary considerably at both extremes of the range. These waxes expand 0.22 per cent in the range between 64 and 84 F.; 0.42 per cent in the range between 84 and 104 F., and 0.50 per cent in the 104-124 F. range, more than double the amount occurring in the first 20 F. range. Calculations based on these values can be made if a wax expansion technic is to be used in compensating for the shrinkage of gold. The average net casting shrinkage of gold has been determined by the Bureau[9] to be 1.25 per cent.

Given a slightly undersized wax pattern, the operator is now confronted with the problem of producing a mold sufficiently enlarged at casting temperature to compensate for the shrinkage of gold and wax. This may be accomplished by practical methods, in the manipulation of the wax and investment.

9. Coleman, R. L.: Physical Properties of Dental Materials (Gold Alloy and Accessory Materials), Research Paper No. 32.

The problem has been simplified by the investigation of dental investments by the Bureau; by the establishing of specifications for inlay investments, and by the cooperation of a number of the leading manufacturers to produce inlay investments meeting these requirements. It should be an inflexible rule among the members of the profession to use only such investments as are supplied with data covering their behavior, particularly when subjected to heat.

When mixed in certain definite proportions, the acceptable investments show comparatively smooth thermal expansion curves, a continuous increasing expansion, from the point at which the moisture is eliminated to bright red heat. This expansion value can be varied by the kind of investment, the w/p ratio and manner of spatulation.

Setting expansion must also be considered. It is difficult to determine how much of the given setting expansion is utilized when the investment is confined by a metal ring. Lining the ring with sheet asbestos will eliminate some of the resistance offered by the ring and thus have a tendency to prevent mold distortion.

Both thermal and setting expansion values show a decrease when the amount of water in the w/p ratio is increased, and an increase when the amount of water is decreased.

The method by which the 1.25 per cent casting shrinkage of the gold, plus the shrinkage in wax from mouth to room temperature, is to be compensated for should be determined before the pattern is invested. Assuming that materials whose behavior can be accurately predicted are being used, satisfactory inlays may be made by expansion of the wax, expansion of the investment or the combination expansion of both.

A procedure which consistently allows castings of the inlay type to be made at 0.05 per cent minus the dimensions of the cavity or 0.05 per cent plus for the type generally referred to as "onlays" and full crowns may be considered satisfactory for all practical purposes.

At the present time, there seems to be a trend away from the use of water bath technic, owing to the development of high thermal expansion investments. Where water bath technics are being used, they are being utilized primarily as an equalizer; namely, to bring back the wax to mouth temperature.

The omission of the water bath is accompanied by the sacrifice of a certain amount of accuracy, and while satisfactory castings can be made by utilizing only the setting and thermal expansion of the investment, more expansion must be obtained from the investment.

Theoretically, it is possible to obtain sufficient thermal expansion in a wax pattern to compensate for gold shrinkage. This is not a safe procedure in practice. The high temperature required to obtain this expansion is invariably accompanied by distortion of the pattern. It cannot be considered good practice to carry wax above 112 F. in any wax expansion process.

If wax expansion is to be used in the process to compensate for gold shrinkage, all possible thermal expansion of the investment should be sought, and the small remaining balance obtained and compensated for by the expansion of wax.

From data supplied by the manufacturers of approved investment materials, and which we are assured will be frequently checked, computations can be readily made as to the amount of setting and thermal expansion which will be obtained at given temperatures for various w/p ratios. Keeping in mind that wax

changes approximately 0.02 per cent for every degree (F.) change in temperature, the amount of compensation necessary can be easily computed.

The details of the investing process must be carefully followed. The investment must be weighed and the water measured in an accurate cylindrical graduate. The mechanical mixer, bowl and spatula must be clean and dry. The remains of a former mix will influence the setting time of the new one. A wet bowl or mixer will change the w/p ratio of the mix. Room temperature water should be kept in a stoppered container.

Mechanical spatulation of the investment is preferred. A denser investment with greater resistance to heat and pressure is obtained. It is of more nearly uniform consistency, is smoother and contains fewer and smaller air bubbles. At least 100 revolutions of the blade must be made, but overspatulation is to be avoided.

All preparations for investing should be made before starting the mix. The wax pattern should be clean and dry and should have been carefully examined, and all small flakes and chips should be removed.

The investment is carefully applied to the pattern with a small camel's hair brush, being pushed ahead of the brush in order that the junction of the investment and the wax may be visible at all times, to avoid trapping air bubbles. The investment is vibrated into the ring lined with slightly moistened sheet asbestos, and the coated pattern is gently vibrated to place. The investment is allowed to set for twenty minutes before elimination of the wax is started.

Slow heating is maintained until moisture and wax are eliminated, after which the mold may be carried rapidly to casting temperature, approximately 1300 F. The ring and investment will be a dull red heat throughout.

The operator must be prepared to cast immediately when the ring is removed from the oven. There will be no appreciable heat loss with resultant shrinkage of investment if the casting procedure is carried through quickly.

Discrepancies in inlay castings are not all accounted for by the control of the three major variables in the process. Some of the minor variables encountered are: variations in shrinkage of gold from the average, 1.25 per cent; variation in thermal expansion due to variation in w/p ratio and spatulation; fluctuation in room temperature and temperature at which the wax pattern is invested; difference in expansion rate of waxes from the average values given, and minor variations due to the method and technic of the individual operator. If the casting is too small, the water bath temperature is slightly increased or the thermal expansion of the investment is increased by changing the w/p ratio. Experimental work must supplement the practical and is of incalculable assistance in determining wherein discrepancies lie.

When good castings are once obtained, every step in the process must be repeated exactly. A standardized individual technic must be worked out and adopted in securing a satisfactory wax pattern, wax elimination and casting. The discrepancies in the compensating factors can be corrected by adjusting the temperature used to expand the wax pattern. The final controlling factor in obtaining acceptable castings is definite and accurate temperature control in the use of the water bath and the expansion of the investment.

All castings should be carefully examined with the aid of a magnifying glass for small nodules which may adhere

to the cavity surface and which may not be visible to the naked eye.

Rough castings are usually due to using too thin a mix of investment; carelessness in investing technic; excessive vibration; too rapid elimination, or overheating the gold.

An inlay fitting the cavity must be relieved on the cavity surface to some extent in order to permit the flow and compression of cement under the inlay. Needless to say, it cannot be relieved to the margins, but, with a free flow of cement, there is a choking off of the cement at the margins, without undue strain on the dentinal walls of the tooth.

We should not consider the inlay completed until it has been set and carefully finished.

A satisfactory inlay can be made. When cemented to place in a properly prepared tooth cavity, it registers continuity at the margins with the surrounding uncut tooth substance. It restores the proximal form and contact with its adjacent neighbor, anatomic contact with its opponents and function to that portion of the tooth which it replaces.

It is conceded that it may be difficult to duplicate in our laboratories the practical results obtained at the Bureau with unusual precision equipment and under definite control. This should not deter or discourage any one. Instead, it should awaken our interest in following the findings of the research laboratory until they are interpreted in terms practical for us, the average dentists.

The greatest mistake a general can make is to underestimate the strength of the enemy. Almost invariably, this leads to disaster. The arch enemy of dentistry is ever present, seeking to nullify our efforts. The dentist who is using inferior materials, or an inlay technic which has been disproved in theory, is inviting such disaster and decreasing the scope of usefulness of the profession.

THE DENTIST IN GROUP MEDICINE*

By BOYD S. GARDNER, D.D.S., Rochester, Minn.

INTEREST in focal infection prompted the organization of the Section on Dental Surgery at the Mayo Clinic fifteen years ago, but today the scope of the section is not limited to the consideration of focal infection alone. Physicians at the clinic, as elsewhere, have come to realize that dental infection acts not only as a focus of infection, but also as a physical load or drag, and, for this reason, extraction of teeth or treatment is indicated. Furthermore, more interest is shown by physicians in the function of teeth, as it is well understood that digestion is often impaired when food cannot be masticated properly, and they realize that lost teeth should therefore be replaced. The physician is learning that patients are interested in their teeth as they are in other parts of their bodies. Many patients incur a great deal of expense and travel long distances

*From the Section on Dental Surgery, Mayo Clinic.

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 8, 1933.

in order to be satisfied that their teeth are in the best possible condition, or to be assured that the dentist they consult is well qualified in his work.

The need for more consultations among dentists might be stressed. Many dentists appear to overlook the fact that they may innocently force patients to become so-called shoppers. The work is so important to the patients that they prefer the opinion of more than one dentist; therefore, when patients visit dentists and there is no consultation, they naturally seek the opinions of others. If the dentist would call another dentist in consultation, the patient would be more willing to allow him to proceed.

It is not surprising that the average physician displays little interest in teeth, since, for many years, responsibility for their care has been passed on to the dental profession. With newer knowledge, physicians are realizing that dental work has been largely a mechanical effort to combat diseases of the teeth.

The Section on Dental Surgery of the Mayo Clinic has put forth every effort to improve diagnostic methods, and to make reports more complete, that physicians may become more cognizant of dental conditions. It is being recognized that dental infection is but one link in the chain of etiologic factors, and its significance is directly proportional to its relationship with other causative factors.

My conviction with regard to pulpless teeth has not varied in these fifteen years. Because a high percentage of such teeth prove to be infected, it is justifiable, I believe, to advise their removal when the systemic condition warrants elimination of all dental infection. This conviction has been further substantiated by a recent editorial,[1] from which I quote: "In view of the results of quantitative cultures by Haden and Rhoads and Dick, it seems justifiable to regard all pulpless teeth as possible foci of infection whether they show apical changes in the roentgenograms or not. At least this position should be taken in the presence of systemic disease of a type usually associated with focal infection."

Attention has been directed to improving the general condition of the patients from whom infected teeth have been removed, since by correct diet or reenforcement of diet, regeneration of bone will take place and infection in the sockets will be eliminated. Rosenow[2] has said: "The dogs in which I was successful in producing chronic foci about the teeth, besides the development of lesions specific for the strains of streptococci inoculated, displayed loss of weight and hair, and became more susceptible to intercurrent infection. A diet sufficient to keep the controls well was inadequate for the dogs who had chronic foci of infection."

The significance of laboratory investigation emphasizing the theory of elective localization continues to be of interest, but with newer knowledge as to the cause of unsatisfactory results in certain cases, more encouragement can be given to patients who have focal infection.

Extraction at the first operation should be limited to a certain number if the patient is a risk. The Section on Dental Surgery in the Mayo Clinic is about to complete the first fifteen years without a fatality. Every effort has been made to select the anesthetic that will give the best result and that will allow the operator to remove the tooth with a minimum of trauma and leave the bone in the best possible condition for restorative work.

1. Roentgenographically Negative Pulpless Teeth as Foci of Infection, editorial; J.A.M.A., 100:974-975 (March 25) 1933.

2. Rosenow, E. C.: Focal Infection and Elective Localization, Internat. Clin., 40:29-64 (June) 1930.

The use of the roentgen rays, from a preoperative and postoperative standpoint, continues to be of great importance in determining the results of surgical interference. Evidence afforded by roentgenograms of the maxilla and mandible reflects, in a measure, the systemic condition of the patient as regards mineralization. Such evidence may reveal retarded regeneration of bone or general demineralization of the bone that supports the teeth. (McKevitt[3] says: "A study of 1,000 complete roentgenograms reveals three distinct types of bone in the alveolar process. They are the normal, the hypercalcemic and the hypocalcemic types.") Obviously, if regeneration of bone does not take place in patients who are able to metabolize minerals, there is lack of intake of calcium and phosphorus. It may be that these two minerals are not in correct proportion. With this knowledge, the unsatisfactory results in cases in which dental infection is eliminated may be accounted for. Many of these patients are found to be consuming far less than half of the daily requirements of both calcium and phosphorus.

It would be presumptuous on my part to dwell too much on calcium and phosphorus metabolism. In a recent article, Dillery and I[4] stated: "After reading numerous articles on the etiology and control of dental caries, we were unable to arrive at any very definite conclusions. It is probable that all of the hypotheses that have been considered in the paper are of some importance, but it is doubtful that any particular hypothesis is the real solution of the problem. It is unlikely that investigators will ever be able to determine the answer to the problem by reviewing the dental literature." I wish to make certain references in order to emphasize the point; that is, that the dentist should evaluate the diets of his patients. This to me appears to be fundamental.

La Mer[5] has shown that 99 per cent of the total calcium in the body is in the bones and teeth, and Bauer, Aub and Albright[6] and others have shown conclusively that trabeculae are formed in bones if the diet is high in calcium, and disappear if the diet is not adequate in calcium. La Mer emphasized that liberal amounts of calcium and phosphorus must be present in the diet to insure growth and a rapid rate of calcification in the body.

Several years ago, we were led to believe that certain large radiolucent areas which were readily revealed by the roentgen rays, especially in the mandible, and many times involving vital teeth, were pathologic. Now we feel quite certain that these are merely demineralized areas. Unfortunately, operations were performed in many such cases, the oral surgeon believing the areas to be infected.

When dentists make use of roentgenograms in examining the mouths of their patients, attention is directed chiefly to the tooth, peridental membranes and adjacent tissues; whereas, the entire mandible or maxilla has a story to tell.

Often, bridges are failures because the foundation of the tooth or teeth which are to act as an abutment is not adequate.

3. McKevitt, F. H.: Atrophy and Hypertrophy of Maxillary and Mandibular Alveolar Process and Their Effect on Stability of Artificial Dentures, J.A.D.A., 19:424-452 (March) 1932.

4. Gardner, B. S., and Dillery, J. L.: Confusion in Literature on Etiology and Control of Dental Caries, D. Cosmos, 75:695 (July) 1933.

5. La Mer, V. K.: Importance of Calcium and Phosphorus in Nutrition, Pennsylvania: Science Press Printing Co., 1932.

6. Bauer, Walter; Aub, J. C., and Albright, Fuller: Studies of Calcium with Phosphorus Metabolism. V., J. Exper. Med., 49: 145-162 (Jan.) 1929.

It must not be overlooked that such foundations are merely biologic, and subject to changes that will defeat the purpose for which the bridge was made.

Because the antrum does not interfere, mandibles are more easily compared from a roentgenologic standpoint. The systemic condition of the patient may be reflected in the roentgenogram of the mandible, and certain diseases will manifest themselves in terms of demineralization.

Reference to a case of acromegaly or of hyperthyroidism will at once reveal to what extent a roentgenogram of the mandible can vary. In acromegaly, because of an endocrine disturbance, new bone may form between the periosteum and the

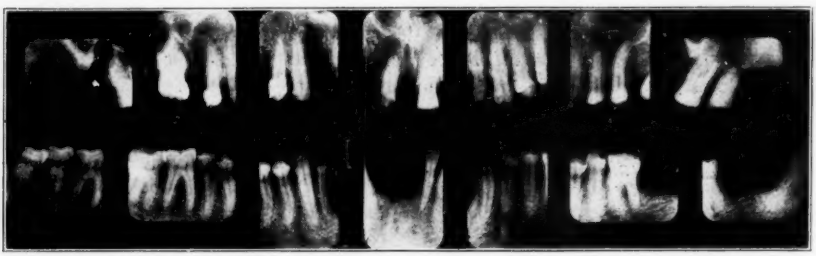

Fig. 1.—Variation in mandible in case of acromegaly.

bone itself, and, in this event, a condition such as is represented in Figure 1 would be expected. In hyperthyroidism, mineral metabolism is interfered with to such an extent that the opposite picture would be expected, as shown in Figure 2.

It is not my intention to cite these two extreme cases or to cite other general conditions with the idea that the dentist may become a general diagnostician, but merely to emphasize those points that will aid him better to observe the material that he has at hand, or at least to stress the importance of closer cooperation between physician and dentist.

Fortunately, most patients who come to the dentist for general work can assimilate food almost normally. Therefore, it would seem to be the dentist's function to suggest the proper diet or diet reenforcement. In determining the patient's intake, it is impractical to get exact weights. About all that could be determined would be the average serving. Hodges[7] and Peterson consider this sufficiently accurate. They have recently pointed out that expression of the mineral content in a unit of cooked food, or in a serving, translates into usable form figures that are virtually meaningless to the average person. Although a serving of food may seem to be an indefinite unit, the plus and minus errors due to the use of this unit would probably compensate one another in the intake of food for a day. Also, because of the great variations in the mineral content of different samples of the same food, variations that may be 100 per cent or more, it is doubtful whether there is anything to be gained by expressing the figures on a more definite basis. Since a 50 per cent margin of safety is to be adopted in all cases, the serving unit is probably sufficiently accurate.

It will be some time before the average physician becomes so "dentally minded" as to assume any responsibility for caries

7. Iron and Copper in Diet, editorial, J.A.M.A., 97:180-181 (July 18) 1931.

and pyorrhea, or to emphasize that they are systemic manifestations. It will be a long time also before the dentist will be sufficiently trained to assume medical responsibility, and during the interim, someone must take the initiative and assume the responsibility. Since dentists are allowed to give a general anesthetic, prescribe narcotics, give drugs hypodermically and do oral surgical work, it would seem to be quite within their scope to become interested in diet. In the majority of cases, they can prescribe suitable diets or reenforcement of diet to combat dental disease.

With the frequent failures that take place in the filling of teeth and in bridgework, it would seem that the dentist must take the initiative, if for no other reason than to protect his mechanical efforts in fillings, bridgework, etc. Teeth that approximate the antrum often fail to be satisfactory abutments, owing to the small amount of supporting bone even when there is little if any demineralization. Such a foundation would be far less desirable if the intake of food was not adequate.

Demineralization does not manifest itself in terms of body weight, and, without doubt, diets which contain adequate calcium and phosphorus will prolong life. This particular point has been ably emphasized by La Mer. It is now well understood that dentist and physician alike must resort to reenforcement of diet, and, at the present time, calcium phosphate with vitamin D seems to be the most desirable agent. Such reenforcement is not necessary if the patient's diet contains vitamin D, with the necessary mineral content. Because American diets are so inadequate in these requirements, diets of patients who come to the dentist for treatment of their teeth will have to be corrected or reenforced. Experience in dealing with this problem has taught the dentist that it is better to start with reenforcement of diet and gradually discontinue it, if it is found that patients are willing to correct their dietary regimen.

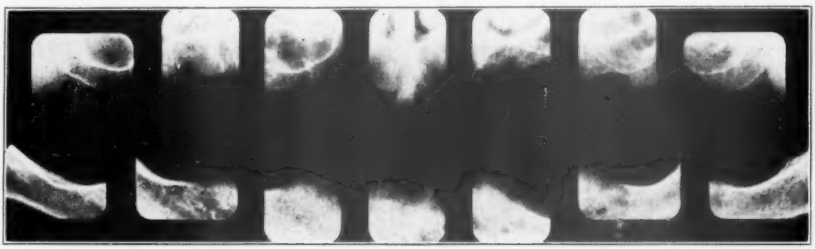

Fig. 2.—Variation in mandible in case of hyperthyroidism.

For generations, we have been victims, more or less, of new ideas concerning food and combinations of foods, without respect to the part they play in health. Many foods are prepared to be pleasing to the eye rather than to the stomach. Sugar had to be refined, and white flour had to be made whiter by bleaching. Moreover, food in general is so prepared as to give little exercise to the teeth. Many persons have formed gastronomic likes and dislikes, and it seems that if a great deal is to be accomplished, it will be done through reenforcement rather than through a radical change in the usual diet.

Teeth, like other parts of the body, must be exercised. A toothbrush is a poor substitute for chewing of resistant foods, unless the handle is chewed. By comparing the maxilla and mandible with other bones, it will readily be seen that the lack of exercise plays a leading part in the problem. For example, bones of a foot which has had no exercise will show demineralization; whereas, the other foot of the same person may present a normal picture.

McCollum[8] has pointed out that infection, if present, interferes with mineral metabolism. The problem as to how patients get into such a vicious circle must be considered. Because of inadequate diet, teeth decay and become infected. Infection interferes with metablism and the condition becomes worse if the resistance of the patient is lowered; infected teeth, which may act as foci, become more of a menace, and one readily sees that elimination of dental infection alone will not bring about the desired results. As demineralization occurs, and resistance is lowered, the tissues of the gum become victims of bacterial invasion and fuel has been added to the fire.

More and more, the dental profession is realizing that it is more necessary to raise the general resistance of the patient to combat periodontal disease than to find out just what organism is present and attack it from the standpoint of some specific drug. A parallel is found in pulmonary tuberculosis, in which no attempt is made to kill the bacillus of tuberculosis, but treatment is instituted, such as rest, proper diet and elimination.

Pyorrhea, like caries, must be thought of as a systemic manifestation which is aggravated by local conditions. Its treatment, therefore, is both local and general. I do not wish to belittle the importance of local treatment, but I do wish to point out that local treatment many times fails because attention is not given to bodily resistance, with special reference to mineral metabolism. In the surgical treatment of pyorrhea, a new line of defense is formed, but unless the systemic condition which was a factor in the condition of the mouth is changed, the dentist in many instances will be defeated in his attempt to arrest the progress of the disease. In other words, he may find at the end of a year or two that the disease has progressed so far that it is necessary to establish another line of defense which may call for extraction of many of the teeth.

It must also be appreciated that if bone was lost before teeth were extracted, bone will be lost after dentures are made. It is regrettable that, in many instances, the foundation for these dentures is lost to such an extent that their service to the patient is badly impaired; whereas, with adequate reenforcement until the correct diet could be instituted, such a condition would have been prevented. With this knowledge, the dentist who extracts teeth seems to have an added responsibility.

Often patients are observed who have lost so much mandibular bone that pressure in these regions becomes almost unbearable. If a cross-section were made of such mandibles, it would readily be seen that they would be similar to weight bearing bones elsewhere in the body. Not only is the trabeculae lost, but the cortical bone also becomes thinned, and bone in general becomes weakened.

Demineralization in cases of osteomyelitis should attract attention, and it should be appreciated that the large percentage of such cases are due to the lowered physical condition of patients, with

8. McCollum, E. V.: Where We Stand in Our Knowledge of Nutrition, M. Searchlight and Sc. Bull., 8:1 (Jan.) 1932.

emphasis on the lack of calcium and phosphorus. Treatment of this disease should include a diet sufficient in these minerals to build new bone in a minimal length of time. According to McCollum: "Calcium phosphate can be given to any patient and should be more generally prescribed as a diet reenforcement." He further states: "If too much calcium is given and not enough phosphorus, then the phosphorus taken is not ingested properly. Although vitamin D is necessary in the metabolism of these two minerals, yet it cannot serve as a substitute for either." Patients often feel that they are taking an adequate amount of milk daily, yet when the daily intake is evaluated, mineral deficiency may be found. The proportion of calcium phosphorus is invariably incorrect, with little if any attention to vitamin D.

Whether harm may come from too much vitamin D in the form of cod liver oil is commented on by Kloster,[9] who found that fisherfolk of the Vadsö region are apparently unharmed by the enormous amounts of fish and cod liver oil which they consume regularly. The question of whether large doses of cod liver oil are harmful has been raised by certain investigations in Swedish laboratories. These showed that young laboratory animals given enormous doses of cod liver oil develop abnormally, their growth and gain of weight being seriously impaired.

Kloster's studies were undertaken to determine whether this observation was applicable to human beings. The people of the Vadsö region do not cultivate corn, and only a few potatoes. They eat fish two or three times a day, and, in the busy fishing season, it is customary for an adult to consume every day about half a quart of "molje," a mixture of liver and liver fat. When storms cut off the supply of fresh fish, salt or frozen fish is eaten, washed down with cod-liver or other fish liver oil. In some of the poorest homes, fish is fried in cod liver oil, and during the six winter months, the average consumption of cod liver oil per day by each person is more than 1 ounce. Some adults drink as much as 300 c.c. of cod liver oil at a time. Babies begin to take cod liver oil when only 4 months old. Kloster was impressed by the excellent state of nutrition of these infants and of the young children in his district, yet they were living under conditions commonly considered unhealthy. The housing accommodations were cramped, and there was comparatively little sunshine throughout the winter. Among the adult population, he sought evidence of chronic cod liver oil poisoning, but found none. The few cases of heart disease that he observed seemed not to be connected with consumption of cod liver oil. The experience of his colleagues and predecessors in the district were in this respect equally negative.

As Price[10] has pointed out, "Our food varies according to the condition of the soil and the time of year it is produced." For example, butter from cow's milk in the summer months is rich in vitamin D, but not so in the winter months.

Dentists should appreciate these changes and safeguard their patients by giving them proper advice. Dentists have an additional problem with patients who have to watch their calories carefully, in order to keep their weight down. Many of these patients, especially girls of high school age, have decayed teeth, and demineralization of the supporting structures. Many of them have been led

9. Kloster, J.: Cod Liver Oil as Food, Science (suppl.), 76:9 (Dec. 23) 1932.

10. Price, W. A.: Why Dental Caries with Modern Civilizations? D. Digest, 39:94-100 (March) 1933.

to believe that milk increases weight, yet Wilder[11] includes milk in meals prescribed for reduction. In evaluating the intake of many of these patients, diets low in calcium and phosphorus are found, with practically no thought of vitamin D. Diets have been materially changed for diabetic patients since the introduction of insulin and the teeth of such children are practically free from caries. Calcium phosphate is now prescribed in reduction diets, together with vitamin D, which not only prevents dental dyscrasia but also eliminates the sting of hunger.

Most children are born with normal mineral balance, since the prospective mother, if not sufficiently nourished in this respect, will draw on her reserve: the bones and teeth. During lactation, there is more of a mineral drain than during pregnancy; which accounts, in many instances, for rapid decay. If infection is present, decay is more likely to occur, since according to McCollum and others, infection interferes with mineral metabolism. Therefore, it is important to eliminate infection during both pregnancy and the lactation period. The extraction of teeth can be carried out safely during pregnancy if too many teeth are not removed at one operation. It is obvious that the dentist should seek medical cooperation in the care of such patients. Sherman[12] says: "In adults, there may be a continued loss of calcium without the appearance of any distinct symptoms because the losses from the blood and soft tissues may be replaced by calcium withdrawn from the bones." This further emphasizes the importance of a diet rich in calcium, especially during the last ten weeks when the fetus is storing calcium at a rather rapid rate.

La Mer stated: "The calcium requirements of growing children are twice the normal requirements of an adult; those of nursing and pregnant women are three times the normal requirement of an adult." It is of interest to note that the fracture of a leg of a cow during the heaviest lactation period is not unusual, for, in experiments on milk production, the animals are fed with only one thought in mind, and such feeding has been shown to demineralize the weight bearing bones so that they are unable to bear weight.

A quotation from McCollum and Simmonds' "Newer Knowledge of Nutrition" is as follows[13]: "The development of sound teeth, capable of resisting the destructive agencies, is essentially a dietary problem. The small jaws and crowding of teeth so frequently seen in children is almost certainly the result of faulty skeletal development, and will be intensified by dietary errors which favor the development of rickets." An opportunity to compare children in Great Britain with those in several of the Scandinavian countries led me to concur in the deductions of these authors.

In Great Britain, one sees many irregularities in teeth, such as decay and pyorrhea; whereas, almost the opposite picture is seen in the rural districts of Scandinavian countries, where mineral intake with food is adequate and the food is of a consistency that causes even deciduous teeth to show abrasion. The exercise develops the jaw sufficiently that irregularities are practically unknown. In Great Britain, food is soft and more refined. The lack of vitamin D is due largely to fogs and smoke. This is further

11. Wilder R. M.: Personal communication to the author.

12. Sherman, H. C.: Chemistry of Food and Nutrition, Ed. 4, New York: Macmillan and Company, 1932, pp. 240-512.

13. McCollum, E. V., and Simmonds, Nina: Newer Knowledge of Nutrition Ed. 4, New York: Macmillan and Company, 1929.

emphasized by the large percentage of children with rickets in such cities as Glasgow.

The dentist who is associated with group medicine or the dentist in private practice should make every effort possible to find and to eliminate infection, and to stress its prevention. He should not be handicapped in making a diagnosis by lack of time or apparatus, and operative procedures, whether dealing with pyorrhea or with the removal of teeth, should be carried out under the strictest aseptic conditions and with minimal trauma. The alveolar process should be left so there will be a suitable foundation for restorative work.

The old slogan, "a clean tooth never decays" has had its day and with our present knowledge should be changed to "a clean tooth, well nourished and well exercised cannot become diseased." Moreover, we can all benefit by McCollum's slogan, "eat what you want after you have eaten what you should."

INVESTIGATION OF TRIBAL SKULLS WITH SIGNIFICANCE TO TOOTH DEVELOPMENT

By LOUIS R. GANS, D.D.S., New Haven, Conn.

AT the outset of these findings, I desire to express my thanks to Prof. Richard S. Lull and associates of Yale University, who have extended to me their cooperation during my examination and study of the classified and tabulated skulls. I deem it a privilege to have had the opportunity to handle these skulls directly from their packing cases as transported to this country at the Peabody Museum from the site of their original discovery. Of particular interest were the skulls from the tribes of Peru, namely the Machu Picchu and the Choqquequkian.

Prof. J. W. Gregory, president of the British Geological Society, 1928-1930, who died recently, uniquely estimated the age of the earth by first determining how salty the sea was. The next step was to find out how salty the land was and then how long it would take the oceans to absorb the salt of the land in sufficient quantities to become as salty as they are today. Geology, then, is the basis of our knowledge of evolution. The records of the rocks, as generalized from the rock systems all over the world, gives us a geologic time scale.

Chronologically, hundreds of millions of years have elapsed since the fishes originated. From the fishes came the amphibians, from the amphibians came the reptiles and from the reptiles came birds and mammals. In the origination of the mammalian group are the greatest variety and greatest extremes of specialization of the teeth to be found in any group. They inhabit the earth, air and water. Bats are an example of those that live in the air, dolphins, porpoises and whales of those that live in the water; while those living on land are innumerable.

HISTORICAL DATA

The varied skulls, jaws and teeth of early animal life, up to the present identification of charted restorations, have played a most important rôle in establishing the records of ancient man. Discoveries dating from 1848 to 1914 have made us cognizant of specific racial characteristics embracing the face and jaw, and existing during each individual era.

The classification of ancient skulls as adopted by historical discoveries may be grouped as follows: (1) Java man, discovered, 1891, at Trinie, Java; (2) Piltdown man, discovered, 1913, at Piltdown, England; (3) Heidelberg man, discovered, 1907, at Heidelberg, Germany; (4) Neanderthal man, discovered, 1856, at Neanderthal, Germany.

The Neanderthal man is estimated to have lived 60,000 years ago. Two skeletons were found in their original burial places in Neanderthal Valley between Dusseldorf and Elberfeld, Germany.

Between 1848 and 1914, various discoveries have been made of series of human fossils belonging to intermediate races. In 1848, the well preserved skull of the Neanderthal race was discovered at Gibraltar. In 1866, a fragment of the lower jaw of the Neanderthal race was discovered near La Nanlette, Belgium. In 1907, the lower jaw with teeth belonging to the race *homo heidelbergensis* was discovered at Heidelberg, Germany. In 1911, portions of the skull and jaw of the type of Evanthropus (the dawn man) were found near Piltdown, Sussex, England. Some of these races are now recognized as "missing links" between the existing human species *homo sapiens* and the anthropoid apes, and others are recognized as the earliest known forms of *homo sapiens.*

TYPES OF SKULLS

The most notable observance in the variance of size and general characteristics of the growth and change of the human skulls is the variance from the prognathous anthropoid jaw with the absence of chin, to man, in whom the jaws get under the cranium and do not protrude. The mandibles of early man appeared to possess more lateral movement, in all probability owing to the force of attrition demanded by the coarseness of the more natural foods.

The progressive development and intellect of man, together with his natural demands, made the rotary motion possible in place of the single snap movement of closing caused by the interlocking of the cuspids and the diminution of these teeth to the same line of occlusion of the anterior teeth.

The infinite variety of forms and numbers of teeth range from six in the fully grown elephant to the thousands in the mouth of the sea bass, and in every case they are the kind that best serve the possessor in its struggle for existence and the propagation of its species. Form and functions are much varied, ranging from the broad flat surfaces of the herbivora, used for the purpose of masticating tough herbage, to the small delicate hairlike forms in some fishes and the specially developed canines and incisors used exclusively as weapons of offense and defense.

In lieu of great fangs for tearing his prey and fighting his enemies, man had learned to fashion weapons for the protection of his kind and as instruments of the chase to procure food. It was the perfecting of his hands and the development of his brain that assured man's preeminence among the primates, and these reacted on his whole body, and

especially left their mark on his jaws and teeth.

It is sometimes difficult to determine to which family, species or subspecies the mammalia belong. These groupings to a considerable extent may be dependent on the teeth and the teeth dependent on environment and the environment on climatic conditions. The climate influences the grasses and herbage on which the herbivora feed, and they were compelled to travel hundreds and sometimes thousands of miles to obtain this food. The carnivora fed on the herbivora, so they in turn were compelled to follow, and among the carnivora were our ancestors—man, who, at this time, was exclusively a flesh eater and compelled to follow the migrations of these animals, to obtain food and what little clothing he required.

It is worthy of note that the skull and the jaws and teeth have played probably the greatest rôle in establishing the records of the antiquity of man; for example, the Australian type of head has nothing in common with the Neanderthal except some minor characteristics of the nose and the region of the forehead and the peculiar form of the upper jaw.

CLASSIFICATION OF TEETH

In the classification of extinct species, the teeth have always played an important part. The various shapes, sizes and functions of teeth have been brought about by two well-known laws, the influence of heredity and environment, and are in accordance with the law laid down by Darwin that if the especial development of an organ be of benefit to a species, that organ will go on improving until it reaches its highest stage of development, but if an organ be of no use to its possessor, it gradually atrophies and disappears.

Climate has always been an important factor in the development of both plant and animal life. As it controls the growth of plants, and herbivora are dependent on these plants and foliage and the carnivora are dependent largely on the herbivora, we can see how climate controls or at least influences all animal life. An example of this is found in the highly developed canine of the wild boar. This tooth was absolutely necessary to his existence when in the wild state, and became the useless tusk after he had degenerated through domestication.

Heredity is a well-known and more or less stable law. It is an influence transmitted from parents to offspring through the chromatic fibers in the germ cell. The influence, energy or whatever it may be is consistently transferred through a line of cells from the human ovum to the offspring. The degree of this transference is uncertain, but if it is of benefit to one receiving it, it is constant in a greater or less degree.

In the consideration of our tooth development, the first fully formed tooth appears as a simple cone. From this cone, with combinations, additions and modifications, the many complex patterns of teeth found in the mouth remain fairly constant.

Nearly all species of fishes live on fishes. A live fish when caught is very slippery and hard to hold, but the cone-shaped tooth of the victor is especially adapted to hold it until it ceases to struggle, and can be swallowed. Curve this backward and it is a weapon hard to improve for the particular purpose for which it was designed, first, as a weapon; secondly, as a prehensile organ in obtaining food. There are four distinct ways in which teeth are attached to the jaws: (1) by the roots, being surrounded by a membrane through which they are attached

to an alveolar process; (2) by ankylosis to the bone; (3) by a fibrous membrane, and (4) by elastic hinges. In studying the skulls of all vertebrates, we find that the openings in the skull are of as great functional importance as the bones themselves.

After the development of a new temporal mandibular joint and the reduction of the posterior jaw elements, the remaining steps leading from a primitive mammalian condition to that which is found in the human jaws today are comparatively simple. They may be broadly summarized as follows:

1. The simple shearlike cheek teeth of the mammal-like reptiles became triangular in cross-sections, the triangles of the lower teeth wedging in between the triangles of the upper.

2. The posterior base of the lower triangles developed a small backwardly directed process called a talonid, which engaged with a similar process growing from the inner side of the upper teeth, thus imitating the famous "tritubercular" upper molar and lower molar occlusion.

3. There was a marked reduction in the number of the postcanine teeth from about ten to seven, the reduction affecting only the more posterior molars and being associated with a shortening of the whole face.

4. A further shortening of the face was accompanied by a reduction and finally by the elimination of the first two premolars, so that, in all the old world monkey and anthropoid apes, the dental formula is reduced to

$$I\ \frac{2}{2}\ C\ \frac{1}{1}\ P\ \frac{2}{2}\ M\ \frac{3}{3}$$

as in man.

Let us consider the points of difference between the jaws and the teeth of anthropoid apes and man.

In a comparison of men and apes, one of the greatest differences is seen in the form of the front part of the upper jaw. It seems very well established that, as the primitive ape-men passed from the semi-erect to fully erect posture, and as the rapidly expanding brain-case became balanced at the top of the progressively up-tilted backbone, the whole front part of the jaws and lips was drawn backward beneath the overgrowing front part of the brain-case. Meanwhile, the lower jaw and the whole head increased greatly in vertical height, but shortened equally in fore-and-aft length. The width across the brain-case increased, the sockets of the lower jaw moved apart and the opposite halves of the jaws became sharply inclined toward each other, so that the front teeth were all drawn backward. The palate and the lower jaw were thus shortened, and the dental arches assumed an archlike curve, the crowding of the front part of the jaw being partly associated with the marked reduction in size of the cuspids and bicuspids.

In man, the jaws are under the cranium and do not protrude, and the mandible develops a chin with genial tubercles on the inner surface at the symphysis for the attachment of the tongue. The cuspids are reduced to the level of their fellows and there is no sexual difference. The upper bicuspids are implanted by single roots, though the first varies from single to two and occasionally even three roots as in the anthropoids.

RACIAL DIFFERENCES

Racial differences do exist. There are differences in tooth form and in the proportion of the dental arch. There is no prior reason to assume that these differences occur sporadically, and are not confined to racial or morphologic types. The

subject deserves more detailed study before it is abandoned.

When today we see the shortening of the mandible and maxillae, the gradual elimination of the third molars, the fusing of teeth, and the appearance of supernumerary teeth, it is for us to know that these things have not come by chance, but are results of laws that are as old as life itself; that these examples are proof of a reversion through the law of heredity to conditions that existed thousands and perhaps millions of years ago. It is believed that the unexplored fields of Asia will eventually produce material in which all the links will have been forged and connected in this chain which represents the evolution of man. And through the study of that evolution must necessarily come a study of life itself, which through all the ages has been considered the mystery of mysteries, but which will become plain and simple, governed by the immutable laws of chemistry, physics and physiology.

In considering the evolution of the human face, we gain a better perspective by beginning with the lowest animals and working upward. It seems that, in the course of evolution, the oldest part of the face is the mouth. The primary business of the face, in fact, is to direct the mouth toward the food. Some of the lowest one-cell animals show this first essential of a face, which leads into a cavity that serves as a stomach.

It is not until we reach a study of the sharks, which are the most normal and typical of the fishlike vertebrates, that we see in its typical form, the vertebrate's face and all the elements which are charactertistic of the face of mammals. Even the familiar landmarks of the human face are all present. We have the nostrils, which are only indefinitely foreshadowed in earlier types. We have the eyes, the mouth, the tongue and the lips. But, in the shark, the whole face is covered with a tough skin.

Observations have also been made on the congenital absence of the third molar. It appears in a rather high percentage in all races examined, with the exception of the West African Negro. The argument favoring the idea that the congenital absence of the third molar is due to the reduction in size of the jaw and the crowding of the teeth cannot be corroborated. The American Negro, the Eskimo, the Buriat and the Australian aboriginal do not show any lack of room due to diminution in size of the jaw, and yet they all present a very high percentage of congenitally missing third molars. Missing third molars have been also observed in chimpanzees. Also, the impacted third molars seem to have no relation to lack of space. They seem to be associated rather with the position of the tooth crown during the formation period than with the room needed for its accommodation.

CARIES

A great variety of causes have been mentioned in the literature as underlying the appalling rise in frequency of caries. Changes in diet and, in connection with this, in the histologic and chemical composition of the tooth substances and in the function of teeth (particularly less thorough mastication) and several other factors have been investigated. No doubt, most of these conditions, especially those mentioned, have considerable influence, but it seems that the striking coincidence between reduction in size of the dental apparatus and increase in caries infections is more than a chance happening. It was shown that the evolutionary trend in the human dentition leads often to crowding of teeth and certainly has brought all the teeth into exceedingly

close contact, leaving but little space for gums and saliva to exercise thejr protective functions. With these considerations, one may well hold evolution itself partly responsible for the rising frequency of caries.

Caries in man occurs in quite different frequencies in the various races. In the Eskimo, for instance, only 2.5 per cent of the people have signs of this disease; American Indians, 3.1 per cent, and Chinese, 40 per cent. European percentage rise from 75 to 100, with fairly well marked variations between different nationalities.

TYPES OF TEETH

Early in man's evolution there existed four premolars on each side of the upper and lower jaws. The first two of these became lost. Gregory considers fourth molars as neomorphs, believing that man is developing a new growth power at the posterior end of the dental lamina. In man, a fully developed unquestionable fourth molar has been reported chiefly from skulls of the lower races.

In the fossil remains of man, the third molar teeth are as large as the second molars. A large third molar tooth in modern man must be considered as a primitive variation. In one of the lowest living human races, the aboriginal Australian, not only is the third molar tooth always very large, but also the alveolar process of the upper jaw extends back of this tooth from one-fourth to one-half inch.

In the white man, the third molar is often rudimentary in character, and its time of eruption is very irregular. Notinfrequently, this tooth never erupts at all or it is even congenitally missing in as much as 19 per cent of the white race. These are all progressive variations of different degrees which form a part of the general evolutionary tendency toward reductions.

Concerning tooth form in relation to race, I have observed that the most obvious variation in human teeth occurs in the upper central incisors.

Large collections of these teeth from different parts of the world showed wide and marked variations in form in all races. It soon became apparent that there were three very distinct forms of human central incisors.

1. The proximal sides of the teeth are parallel for one-half or more of the length of crowns, reducing the interproximal space.

2. The proximal sides of the teeth rapidly converge from the incisal edge to the cervical.

3. A double curve appears on the distal proximal surface and often on the mesial.

All the teeth in any given set partake more or less of these typal characteristics of the upper central incisors. The greatest variation in human teeth occurs in the upper lateral incisors and in the third molars. All races have three types of teeth with certain minor racial variations. There is no doubt that the change in the human denture is intimately related to the change in the human diet.

Again, in accordance with the particular uses, necessities, functions, heredity and environment with which the classified man was compelled to use his teeth, we find the human dentition has altered its apparatus from the ancient formula.

$$\text{In } \frac{3.3}{3.3}\ \text{C}\ \frac{1.1}{1.1}\ \text{P. M.}\ \frac{4.4}{4.4}\ \text{M.}\ \frac{3.3}{3.3} = 44$$

to

$$\text{In } \frac{2.2}{2.2}\ \text{C}\ \frac{1.1}{1.1}\ \text{P. M.}\ \frac{2.2}{2.2}\ \text{M.}\ \frac{3.3}{3.3} = 32$$

But comparative anatomy is indeed futile unless its results are reached in

connection both with the geologic time record and with systematic zoology.

The numerous forms and functions of teeth have undoubtedly been transformed by the influences of heredity and the existing conditions at that particular stage of civilization. The natural steps of earth maturity, and the locality, climate and, in fact, all the advancement to civilization, have affected the growth and development of the teeth and human structure.

That the variations and absence of individual teeth are confined to any particular race or tribe is conclusively set aside by the findings of Maximilian de Terra of the Anthropologic Institute of the University of Zurich, in his *Beitrage Zu einer Odontographie der Manschenrassen.*

From the preceding tables I believe I ought to draw the conclusion that reduction or lack of second incisors and third molars is not peculiar to the Europeans only, that on the contrary both phenomenon occur in other races also. Whatever happens to the third molar, its frequent reduction occurs in the case of Malays, Arabs, Birmans, etc. In the case of Europeans, the atrophied condition of the second incisor is however, more often met with.

It is not seldom that I find lack of reduction of second incisor or third molars in my patients. Since I, on account of lack of time, could not always go into an exact notation, I can only call upon a few observations, especially on those of which I have made plaster of Paris casts. (These casts are in the University of Zurich.)

A complete absence of third molars in both jaws I found eight times (in about 500 patients) five times in male and three times in female individuals. The upper third molar was lacking in twenty-three cases (fifteen male, eight female), the lower third molar in twelve cases (seven male, five female). The above upper right third molar was not present four times, the upper third molar seven times and the lower right third molar one time.

Reduced third molars are present in the upper jaw so often that I took notice of very extreme cases only. Often, the third molar of one side is stunted, while the one on the other side is almost lacking.

SUMMARY

The whole scheme of the innumerable changes in bony framework, skulls and teeth that have been pieced together by untiring investigations and research workers may be broadly summarized as follows:

1. From time immemorial, to their possessor, teeth have served as weapons of offense and defense and, to this day, maintain their most important significance as regards the health and well being of their possessors.

2. As regards man and his dental apparatus, observations are conclusive that caries, alveolar abscesses and bone destruction have exisited in all tribes and races.

3. Throughout the examination of all the skulls of the widely collected tribes and races, there remained the constant symmetrical shape and size of the human teeth according to the skull observed, regardless of its origin.

4. There has been a total loss of the fourth molar and a gradual reduction in the size of the third molar, ascribed, in essence, to lack of exercise and function.

ESTHETIC VALUE OF PORCELAIN IN FIXED BRIDGE RESTORATIONS*

By J. E. ARGUE, D.D.S., Seattle, Wash.

THERE is quite a general recognition of the esthetic value of porcelain in fixed bridge restorations, but many hesitate to make complete use of it in this connection because of a belief that it affords too little resistance to occlusal stress. This objection can be satisfactorily overcome, by the use of modern hard gold alloy castings in combination with the porcelain.

The indications and suggestions for the practical application of this technic, will be taken up later, under "Bridge Construction."

While satisfaction of the esthetic sense is extremely desirable in dental restorations, they must at the same time be made with some reasonable assurance of strength and stability.

With the increasing demand for the reproduction of natural conditions in dentistry, more of the profession should recognize the existing necessity, and become qualified to master the details of this valuable type of service.

A thorough study should always be made before the construction of any bridge is attempted. Then, in order that efficient dependable service may be assured, the principles governing this technic must be correctly applied.

A roentgenogram is made and a full impression is taken of the case. The resulting model is mounted on an articulator in order that a general survey of conditions may be made. Any unhealthy condition of the teeth and investing tissues should be corrected before any plans are devised for this type of construction.

FIXED BRIDGE CONSTRUCTION

The fixed bridge consists, first, of attachments for the abutment teeth supporting the bridge, and secondly, of the pontic teeth supplying the teeth lost.

Abutments.—Abutments may be considered under two general headings: (1) three-quarter gold casting and (2) the cast gold coping in combination with the porcelain jacket crown.

Three-Quarter Abutment Casting.—Since there are various technics for this operation, I shall mention only a few precautionary measures to be taken toward avoidance of an unnatural looking result. I have particular reference here to the indications for and preparation of the abutment tooth in order that esthetic results may be maintained.

This type of abutment is recommended for incisors, cuspids and bicuspids whose labial and buccal surfaces are free from caries and, generally speaking, from restorative work of any character.

The abutment tooth should first be separated from the proximating teeth in order that every possible advantage may be had in an effort to secure an outline form which will be extended into an

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 8, 1933.

immune area and, at the same time, present no conspicuous display of metal when the case is completed.

The incisal outline for the upper anterior teeth should be carried up only to the labial plate of the enamel incisally, and because the incisal surfaces of the lower anterior teeth are more conspicuous in a general observation of the mouth than are the upper teeth, the incisal outline should be made linguo-incisally, leaving the whole incisal surface intact; which conserves the natural beauty of the lower anterior teeth. (Figs. 1-4.)

The buccal outline at the mesial and distal aspect of the upper and lower bicuspids should be minimized as much as possible for the best esthetic result. (Fig. 5.)

Cast Gold Coping.—The cast gold coping is placed on the abutment tooth for the purpose of affording attachment to and support for the bridge when it is set to place. A porcelain jacket crown made in the usual way over this conceals the gold, an esthetic appearance resulting as regards the abutment tooth. A tapered spur is made to extend incisally or occlusally on the coping to assure, at the mesial or distal aspect, the correct relation of the soldering attachment for the bridge. Exercise of the greatest care cannot be too strongly emphasized in the use of this attachment, because of the possibility of pulp involvment when it is improperly used. It

Fig. 1.—Upper incisor and cuspid preparation for three-quarter casting with limited extension at mesial, distal and incisal aspects.

Fig. 2.—Casting in place on incisor; showing how gold can be concealed by properly limiting outline.

Fig. 3.—Lower incisor and cuspid preparation, limiting extension at mesial and distal aspects and leaving incisal surface intact.

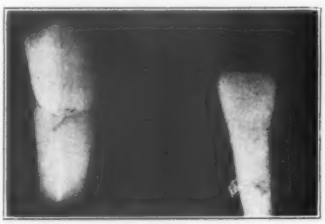

Fig. 4.—Tooth forms illustrating esthetic values possible with outline.

perhaps should here be stated that this type of abutment is particularly recommended for teeth with vital pulps from which most of the enamel has been lost.

Much trouble can be avoided in the preparation of this type of abutment if there is definite knowledge that the pulp has receded sufficiently to permit of the correct preparation with enough dentin remaining to protect the pulp. This type of abutment, obviously, is not indicated for young patients. The roentgenogram will be a great help in determining to what extent pulp recession has taken place.

Fig. 5.—Outline for abutment casting on bicuspids; also buccal view.

Fig. 6.—Upper and lower incisors showing no gold at labiogingival aspect.

To meet the varying requirements, one of three different types of gold coping may be used. In the first type, the upper and lower incisors and cuspids and the upper first bicuspids, the outline for the abutment is so made on the teeth that the gold will not extend on the labial or buccal aspect. The shoulder on this gold coping, being continuous with the shoulder, is made directly on the labiogingival surface of the tooth itself. (Fig. 6.)

In the second type, in the lower bicuspid abutment teeth, a full casting can be made with a gold shoulder extending all the way around the tooth; which makes a stronger casting. The gold does not show to any extent at the buccogingival aspect. (Figs. 7-8.)

Fig. 7.—Lower bicuspid gold coping with shoulder on gold all around tooth.

Fig. 8.—Lower first bicuspid gold coping set to place with porcelain jacket crown seated on coping.

In the third type, for the lower incisors and cuspids, the gold is extended farther gingivally on the labial surface than on the upper teeth. This is necessary, owing to the difference in the line of stress from the occlusion. (Fig. 9.)

These preparations are all so made that the castings can be shaped to a fine smooth beveled edge at the gingivae. When the preparation is complete, a

copper band is made that will go slightly under the gingivae.

An impression is made with modeling compound. This is run up with "kryptex." When hardened sufficiently, the impression is removed, and the surplus "kryptex" is trimmed off with a paper disk in the engine. On this model, the wax pattern is made, and when it is

Fig. 9.—Comparison of upper and lower incisors, with gold copings in place showing gold extended more labiogingivally on lower incisor.

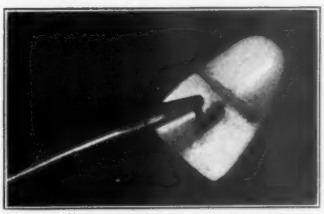

Fig. 10.—Incisor held in lock pliers while gingival tip is built.

cast, the gold is trimmed with disks, and fitted first on the model, then to the tooth in the mouth.

Pontics.—There are two forms of the porcelain pontic which have been generally used. The first type, in addition to the general form of the crown, has added a root end, which should be very short, less than one fourth of the original root.

The second type is constructed with a saddle form at the gingival aspect which is adapted to the mucosa at the crest of the ridge. This type has given the most satisfactory results.

In considering the esthetic results that are possible in constructing pontics which

Fig. 11.—Upper incisor pontic with gold backing fitting with flat joint at incisal aspect.

Fig. 12.—Buccal cusps for upper bicuspids and molars shaped to promote esthetic values.

can be depended on for practical service, the following may be taken up in regular order of their location in the mouth, and necessarily their forms should be worked out in detail to serve in a practical way, as well as an artistic unit to the restoration.

There are four different types of bridge pontics, classified as follows: (1)

upper incisor and cuspid pontics; (2) upper bicuspid and molar pontics; (3) lower incisor and cuspid pontics, and (4) lower bicuspid and molar pontics.

Because the occlusal surfaces of the lower teeth are more conspicuous, in a general observation of the mouth, than the occlusal surfaces of the upper teeth, the indications for porcelain are greater when the construction involves the incisal

Fig. 13.—Buccal cusps for upper bicuspids and molars shaped to promote esthetic values.

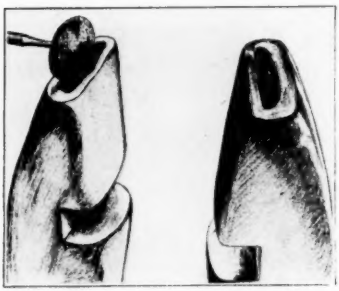

Fig. 14.—Lower incisor and cuspid pontic construction.

and occlusal surfaces of the lower teeth.

Though the regular stock teeth do not always come in the proper color distribution, from the gingival to the occlusal aspect, they may be advantageously used. When it is necessary to change this shade arrangement, it may be done by grinding out the porcelain in the area which does not harmonize, and baking on a porcelain body of the desired color.

Upper Incisor and Cuspid Pontics.—A steel facing is selected for color, size and tooth form. The slot on the lingual aspect is widened with a carbo disk for the reception of a lug, which is cut from an ingot of hard gold.

The tooth is beveled off at the labiogingival somewhat, with a heatless stone. The facing now is placed in a pair of lock pliers, so that it can be held firmly, while the porcelain body is added. (Fig. 10.)

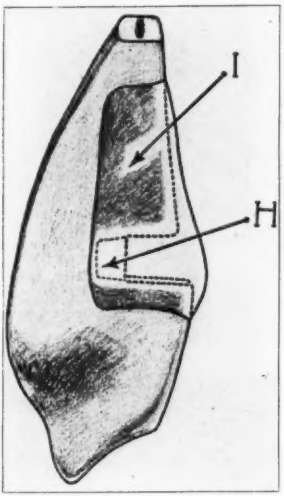

Fig. 15.—Outline of cast backing, showing support to incisal tip.

A shade of 2440 porcelain is selected that will harmonize with the gingival area. With this, the gingival form is built on and baked to a high biscuit, but not to a glaze. It should be allowed to cool down to about 800 degrees before it is removed from the furnace. A heatless stone now is used to shape this to the proper length and form to fit to the soft tissues.

Some 2300 porcelain is selected with the colors for the gingival middle and

incisal thirds. The flattened end of an orange wood is fitted tightly into the slot at the lingual margin, to serve as a handle to hold the pontic while the 2300 enamel body is placed. This, when baked, should be brought to a nice glaze, so that the gingival part of the pontic will be smooth and nonirritating to the mucosa when it is placed.

A three-fourths inch carbo disk is used to produce a flat surface for the reception of the gold backing. The gingival shoulder, after being squared, is given a slight bevel, and, at the incisal of the pontic, is made square gingivo-incisally with the tooth, meeting the gold with a flat joint. It has been found that, when hard gold is used, it gives ample protection to the incisal edge of the porcelain.

Fig. 16.—Lower bridge restoring two central incisors with three-quarter casting support on lateral incisors.

The advantage in this method is that, after the bridge has been placed, the teeth can be shortened, or the incisal form changed by trimming with a course cuttle fish disk. This is occasionally necessary to add a touch of harmony, which is very often the case after anterior teeth have been permanently set to place. (Fig. 11.)

Upper Bicuspid and Molar Pontics.—The long pin facing makes a very practical tooth. To begin with, a platinum bar of 30 gage is soldered on the ends of the pins. This should be cut about 1 mm. wide and just long enough to extend across the pins. A small amount of pure gold is fused on each end to contact with the pins.

Wet borax is applied to the end of each pin. The bar is set on to the end of the pins. A hot spatula is held on top of the bar until the heat crystallizes the borax. This sets and holds the bar in place temporarily. It is then placed in the furnace and heated to 2200, which solders the bar to the pins.

Fig. 17.—Bridge in place; showing esthetic values possible.

The pontic is made in the usual way, and ground up to form and fitted to the case. The enamel body is then placed on the surface and baked to a glaze. This is shaped with a carbo disk. It is squared up at the gingival shoulder and beveled slightly.

The buccal cusps are ground, and when they are given the correct bevel, the gold can be extended over the occlusal ends for strength. This, when minimized on the tip end of the buccal cusps, shows

but little from the buccal aspect, which adds much to the esthetic values. (Figs. 12-13.)

Lower Incisor and Cuspid Pontics.—These cases I have found to be the most exacting of all, because, the teeth being small, there is less bulk of porcelain for strength. A steel facing has been found very practical for use in constructing this pontic. After the selection is made, the lingual slot is widened with a carbo disk.

The colors of a porcelain body are selected to build the incisal portion, also to build the gingival tips, which are built up in two bakings of 2440 porcelain.

In the first, the lingual slot is filled except at the middle third. A space of about 2 mm. is left unfilled. This, when baked, forms a slot into which a gold lug can be fitted, providing anchorage for the pontic, when it is cemented to the gold backing.

Fig. 18.—Diatoric tooth, with handle attached and wood point to form lingual hole, ready for placement of porcelain.

The full form for the incisal and gingival tips are built up, leaving a space of about 2 or 3 mm. at the middle third between the two, forming a mesiodistal slot in the pontic. This forms a shoulder on the backing when it is cast, for the purpose of giving added resistance to the stress of occlusion on the pontic.

A high biscuit bake is now given the porcelain. It is then ground to the proper size to fit the case. The shoulders on the gingival and incisal tips are squared up with a carbo disk. The incisal tip is ground to a form harmonious with the other teeth in the mouth, and if they have been worn, and the incisal dentin has taken on some stain to a greater or less degree, this can be very artistically reproduced by grinding a groove with a small knife edge stone in the surface of the pontic, to represent in size and form the incisal stain in the natural teeth.

A porcelain stain of suitable color is selected, placed in this groove and baked. When the enamel is baked over this, a beautiful reproduction results, harmonizing with the incisal surfaces of the teeth in that mouth. (Fig. 14.)

The wax patterns are now formed for the cast backings. The outline is made to cover the lingual aspect around from the mesial to the distal, and carried up well incisally to support the incisal tip against the occlusal stress of the upper teeth, protecting the porcelain from possible fracture. (Fig. 15.)

The backings are cast in hard gold to give as rigid a support to the pontic as possible. (Figs. 16-17.)

Lower Bicuspid and Molar Pontics.—These are made entirely of porcelain and can be recommended only in cases wherein there is sufficient space between the occlusal surfaces of the upper teeth and the mucosa of the lower ridge that a porcelain tooth not less than 10 mm. long can be placed for the necessary bulk of porcelain for strength.

If the bite is close and these lower pontics must therefore be made short, long pin facings should be used. Hard gold on the occlusal surface carried well over the buccal cusps for the necessary protection of the porcelain is recommended from the standpoint of service.

It has been found that most of these cases occur in persons who have heavy, close bites, and do not show the occlusal

surfaces of the teeth to any great extent, and where esthetic values need not be considered so seriously.

The lower diatoric stock teeth can be used in a practical way to construct the all-porcelain tooth. The selection is made in color, size, length and occlusal form. They are first ground to occlude with the opposing teeth. The form of the occlusal surface can be changed if desired, in the building of the porcelain body in forming the pontic.

The buccogingival end of the tooth is ground off and, with a carbo disk, the mesial and distal holes are opened to allow easy access in placing the porcelain. This is now cleansed with chloroform to remove impurities and wax, and a shank of a bur is attached to the buccal surface with hot sealing wax or shellac, which serves as a convenient handle to hold the tooth while the porcelain body is built up.

To provide for a hole in the pontic at about the middle third on the lingual aspect, a wood point about one-half inch long is cut from a medical applicator, which is about the right size for a molar. For a biscuspid, it is trimmed down to about two-thirds its diameter.

The end of this stick is attached to the inside of the buccal edge of the large hole in the gingival end of the tooth, with hot shellac, the stick extending lingually. (Fig. 18.) The wood burns out in the baking, leaving the necessary hole at the lingual.

The proper color of porcelain body is selected, and this is now built up around the wood point, which stays intact while the pontic is given its general form. A sufficient bulk of body is added to allow somewhat for the shrinkage in baking, and when completed, any porcelain filling the shoulder at the mesial, distal or lingual aspect of the tooth should be removed with a porcelain carving spatula. The temporary handle is now carefully detached with the sharp point of a knife. The pontic is then placed on a baking tray in front of the regular oven, or in a low heat oven to dry out, then baked to a medium biscuit.

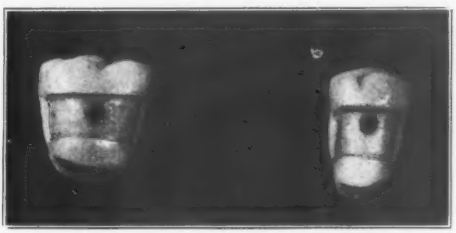

Fig. 19.—Bicuspid and molar all porcelain pontics, showing lingual hole.

If it has cracked or checks have formed, they should be carefully filled with porcelain.

A new wood point shaped to fit the hole at the lingual aspect is placed to keep this from filling with the wet body, then it is rebaked.

The pontic is now ready to be ground to form. The hole at the lingual aspect can be enlarged by selecting an old shank from a mounted stone about the right size, and, with wet carbo powder, grinding it out to the size of a 16 gage wire for a molar, and an 18 gage for bicuspid. The size is varied on account of the difference in bulk of porcelain for the different teeth.

The form is definitely ground and shaped to fit, and then, with a well trued carbo disk, the shoulder at the lingual aspect that extends around mesially and distally is squared up, and deepened to give a good ledge, with a definite form to fit into the backing.

A clasp metal wire is fitted in the lingual hole, leaving about 1.5 mm. extending.

The wax pattern is made as heavy as possible, being attached to the lingual end of the wire post with a hot spatula. The outline is extended from the lingual aspect well around on the mesial and distal, and well up on the lingual cusps. This should be cast in hard gold, with sufficient bulk that the backing will not spring when the case is subjected to the occlusal stress.

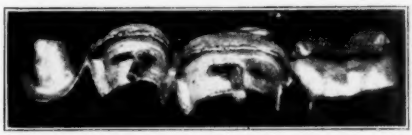

Fig. 20.—Assembled bridge, showing shoulder support on backings, also pins.

The lingual post that is attached to the backing and extends linguobuccally into the porcelain is intended to give cementing anchorage, in order that the pontic may be held firmly to the supporting shoulder of the gold backing. (Figs. 19-20.)

In the lower bicuspid and molar teeth, the occlusal and buccal surfaces are the part of the pontic which is observed in the general expression of the mouth. The gold backing on the lingual aspect is not seen as a general rule, and when the color and tooth form of the occlusal and buccal surfaces are given necessary artistic detail, an esthetic result may be obtained in these lower bridge restorations. (Fig. 21.)

The greatest concern should be given to the fitting of the gingival tip of any porcelain pontic to the mucosa of the alveolar ridge. A method which can be relied on, and which may be applied to any kind or type of pontic is this:

When the tip has been built up, baked to a high biscuit, and ground to the approximate form to fit the case on the plaster model, the tip is left slightly longer than necessary. The backings are cast, and the bridge is assembled in the usual way.

The bridge then is taken to the mouth and carefully adjusted to place. The pontics are then removed and placed on the bridge, which is then slipped on the abut-

Fig. 21.—Lower completed bridge, with all porcelain pontics, also cast gold coping with porcelain jacket crown on first bicuspid.

ment teeth and only partly pressed down to place.

The pontic is removed and the excess ground off the tip so that it will set snugly to place when the bridge is completely down on the abutment teeth.

This, after receiving a highly glazed surface, will be less irritating to the mucosa than anything at our command. The tooth form also can be changed by grinding its surface where necessary.

The pontic is now removed and cleaned, and a suitable holder is attached to the tooth to hold it firmly while the enamel body is being placed.

The colors are selected for the gingival

middle and occlusal thirds in 2300 porcelain. This is best manipulated when just moist enough that it can be spread easily on the tooth surface with the carving spatula, and the desired form be maintained without change.

The building of the enamel body is first started on the gingival tip, then carried over the exposed surfaces of the tooth, correcting the tooth form and varying the shade in detail. When the baking of this enamel body is carefully timed, so as to reproduce the texture and smoothness of the teeth in the mouth, a satisfactory degree of harmony results.

Adding and building the enamel body in this way makes it definitely possible to construct pontic teeth of higher esthetic value and with a more certain adaptation to the gingival tissues.

LOCAL ANESTHESIA AS APPLIED TO THE CHILD*

By C. W. HAGAN, D.D.S., Pittsburgh, Pa.

THE primary procedure in anesthesia is the selection of an anesthetic. This statement may seem superfluous; on the contrary, it is of supreme importance. The choice of anesthetic, whether local or general, is the rock on which many of us are stranded even before we are well started on our voyage. Many operators, especially those who work for adults as well as children, have some anesthetic which has proved successful in the majority of cases, and therefore is used in all cases, regardless of the operation and regardless of the patient, unless, perhaps, he is so young and so forceful in his objections that, to preserve the peace and harmony of the office, he is sent elsewhere. Local anesthesia is not indicated for all children, nor is it advisable in all cases to use a general anesthetic. The question as to what to use can be answered only after a careful study of the patient, taking into consideration the age, the general physical condition and the temperament. It is obvious also that the type of operation to be performed determines in large measure the choice of anesthetic.

AGE OF THE PATIENT

When operating for a child under 5 years of age, it is advisable to use a general anesthetic. Until a child reaches the age of 4 years, its actions and attitudes are purely instinctive and emotional, and reasoning has little or no effect. Because of this, the reactions are apt to be more primitive and the impressions formed of longer duration than those of the adult or older child. During this period, the operator should take every precaution to avoid unpleasant and painful operations, and, at the same time, extend every effort to make the patient's impression of himself as favorable as possible.

A young child can rarely distinguish between an unusual, strange feeling and pain. Therefore, even though perfect local anesthesia has been secured, the resultant strain produced by the leverage

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 9, 1933.

of the instrument and the sound of the tooth breaking away from the process is interpreted as pain. In the patient's mind, he has been hurt. Therefore, for all practical purposes, the anesthesia has been a failure and the operation has produced an attitude toward the dentist which it will be very difficult for him to overcome.

General anesthetics produce complete unconsciousness and the operation is performed without any sensation on the part of the patient. It is true that when he awakes, the postoperative discomfort is present, but this does not provoke the antipathy toward the dentist nor produce the same mental attitude which follows the operation performed while the patient is conscious.

PHYSICAL CONDITION

The physical condition of the patient has an important bearing on the decision as to the type of anesthesia to be selected.

It is not the intent here to discuss the toxicity of the various drugs used as anesthetics. Rather, I desire to point out certain conditions which militate against the successful use of a local anesthetic in the case of a child.

Children suffering from nervous or mental disorders are apt to prove unsatisfactory patients under local anesthesia. The nature of their ailment causes them to be restless and prevents them from relaxing. It also increases their imagination and produces a tendency to enlarge on their sufferings.

The mentally deficient child is rarely a fit subject for infiltration or nerve blocking. In these cases, it is necessary for the operator to disregard the physical age of the patient and consider only his mental development.

Pain and loss of sleep are other adverse factors in local anesthesia. The child who has been suffering over an extended period with a consequent loss of sleep is high strung and nervous, which makes him apprehensive and fearful. For this reason, an operation performed while the patient is fully conscious, even though his sensory nerves are anesthetized, may produce a psychologic effect which it may be difficult to overcome.

TEMPERAMENT

The temperament of the patient must always be considered before any operation is performed on children. This is especially true of one involving the use of the hypodermic needle.

The greatest handicap which a dentist has to face in the treatment of his child patients is fear. This emotion has been overstimulated in the majority of children, especially those who are visiting the dentist for the first time, and must be overcome by the operator before he can hope to secure the confidence of the child. If the fears of the terrorized patient cannot be overcome prior to the operation, all extractions should be performed under a general anesthetic, for the same reasons which determine in part the selection of a general anesthetic for the very young child.

It is necessary in all types of cases to get the complete cooperation of the patient before any anesthetic which deadens the sensory nerves, but at the same time leaves them conscious, is used. For this reason, general anesthesia is preferred in the hysterical type, and in that child who, through lack of home training, has never known any restraint, nor responded to any commands, save those of his own desires.

TYPE OF OPERATION

The type and extent of the operation to be performed should have a definite bearing on the choice of anesthetic. In the case of extraction of a few teeth or of a minor operation consuming but a

short time, we may use a local anesthetic, provided all other conditions are favorable. If the operation extends over an appreciable length of time or involves an extensive loss of tissue, general anesthesia is always indicated. If the latter type of operation is attempted while the child is conscious, the mental shock is greater to the patient than that caused by the general anesthetic.

DRUGS USED AS LOCAL ANESTHETICS

There are a great variety of drugs used to produce local anesthesia, but of these, there are but three sufficiently known and sufficiently used in dentistry to merit any discussion here. They are ethyl chloride, cocaine and procaine.

Ethyl chloride was at one time used quite extensively as a spray applied directly to the part. The anesthesia produced was so transitory and had such slight penetrating qualities that it was soon discarded.

Cocaine hydrochloride was for years used by dentists by means of the hypodermic injection. The anesthesia produced was deep and lasting, but the drug was very toxic and, on the discovery of procaine, it was discarded.

Novocaine, or procaine, was discovered by Einhorn in 1905. This material answers the requirements of a local anesthetic so satisfactorily that it has almost supplanted all others.

ANATOMIC STRUCTURES

To be successful in the use of local anesthetics, the operator must have a thorough knowledge of the anatomy of the various parts involved. For this reason, I shall review briefly the anatomy of these parts.

The nerve supply to the teeth is from the fifth cranial or trifacial nerve. This nerve arises from the surface of the pons varolii and extends anteriorly to the superior border of the petrous portion of the temporal bone. Here, it forms the gasserian ganglion, from which proceed the three branches; namely, the ophthalmic, the maxillary and the mandibular. The ophthalmic nerve does not supply any tissue in the mouth. The second, or maxillary, division of the trifacial nerve leaves its origin in the gasserian ganglion and passes through the foramen rotundum to the sphenomaxillary fossa, and thence through the infra-orbital canal. Here, it becomes the infra-orbital nerve. It has various branches, but those of interest to the dentist are the posterior, middle and anterosuperior dental branches and the sphenopalatine branch.

The sphenopalatine divides at Meckel's ganglion into several branches, among which are the anterior, middle and posterior palatine and the nasopalatine nerves. These supply the mucous membrane of the palate and the internal alveolar plate of the maxilla.

The infra-orbital nerve as it passes through the infra-orbital canal gives off the middle and anterosuperior dental branches. These branches supply the anterior and bicuspid teeth, also the alveolar process. Before it enters the infra-orbital canal, the maxillary nerve gives off the posterosuperior dental branches to the maxillary tuberosity. These pass forward and finally anastomose with the anterior and middle superior dental nerves. They supply the mucous membrane of the mouth and the molar teeth.

The infra-orbital branch is the terminal portion of the maxillary nerve. It emerges from the infra-orbital canal by way of the foramen of the same name. Here, it divides into several branches which form a plexus, sending branches to the oral mucous membrane and the incisors and cuspids.

Through the anastomoses of the various nerve branches of the second division of the fifth nerve, there are formed two

nerve loops which supply the maxilla. These are described by C. H. Hawkins as follows:

> The outer loop made by the posterior, middle (?) and anterior alveolar nerves, supplies the muco-periosteum, external part of the alveolar process and the pulps of the teeth, whilst the inner nerve loop formed by the posterior, external and anterior palatine nerves, anastomosing with the naso-palatine nerves, provides sensation to the soft and hard palate and the internal layer of the alveolar process. It will be seen that for what is known as "conservative" operations on the teeth a block of the outer loop is alone necessary, whilst for the painless removal of teeth it is essential to block both loops.

The third or mandibular division of the trifacial nerve leaves the skull by way of the foramen ovale. Here, it divides into a superior and an inferior root. The superior root is chiefly motor, while the inferior is chiefly sensory.

The buccinator or long buccal nerve is the only sensory branch given off from the superior root. This nerve supplies the mucous membrane of the cheek. The inferior dental and lingual nerves are given off from the inferior root. Their distribution is described by Fischer as follows:

> The main trunk of the third division of the trigeminal is the mandibular or inferior dental nerve. After giving off the mylohyoid branch, it enters the long mandibular or inferior dental canal, passing along with the artery and venous plexus below the roots of the molars. Before its entrance into the canal, it gives off a few delicate twigs to the oral mucosa and the periosteum; within the canal it is frequently subdivided into several parallel branches. One of these extends as far as the central incisors, where it anastomoses with the nerves of the other side. At the mental foramen it gives off the mental branch which supplies the anterior labial surface of the mandible, the mucosa, and the lower lip. In its course the inferior dental nerve, in close relationship to the corresponding vessels, gives off two large separate branches, a posterior branch to the molars, and a middle branch between the mandibular and mental foramina to the bicuspids.
>
> In front of the inferior dental nerve, the lingual nerve passes to the tongue, sending off on its way a side branch which is minutely broken up in the anterior portion of the mandible. In the bicuspid region it ascends, finely distributing itself in the periosteum as far as the genial tubercles.

In studying the bony structure of the maxilla and mandible, we find that the cortical plates of these bones are pierced by numerous canaliculi. These are of particular importance in local anesthesia, as it is through them that the solution penetrates the dense bone and reaches the nerve endings beneath. It is these canaliculi which make "infiltration" possible. This cancellated structure varies greatly with the age of the patient. In the child, the bone is more porous and the perforations are found in a greater variety of locations than in the adult.

In the maxilla, the canaliculi are found principally in the alveolar ridges, the anterior and middle portions of the hard palate, the apical region of the teeth and the bone overlying the bicuspids. As the individual grows older, the number of openings lessen and the bone grows denser.

In the mandible, the cancellous areas in the adult are limited to the alveolar ridges, the region of the chin and the lingual portion around the genial tubercles. In the child, we find canaliculi even in the molar region.

The study of the anatomy of the jaws proves that infiltration anesthesia is indicated in the child for operations involving the maxilla. This is made possible by the cancellous structure of the bone, which permits the solution to reach and render insensible the nerves of both the outer and the inner loops by means of a subcutaneous injection.

While the mandible of a child is more porous than that of an adult, the bone

is denser than that of the maxilla, particularly in the molar region. For this reason, although infiltration anesthesia may serve in many cases, complications will arise in which it will be necessary to block the nerve supply to the entire area.

In the child, the bones of the skull are not fully formed. This immature growth is demonstrated in the mandible by the angle formed by the ramus with the body, also by the location of the inferior dental foramen.

At birth, the angle formed by the lower body of the mandible with the posterior border of the ramus is very obtuse, but with the eruption and development of the teeth, the angle becomes more acute, until in the adult it is almost a right angle.

With the growth and increase in strength of the muscles attached to the ramus, that portion of the bone also increases in size, until it has a square appearance.

In the adult, the inferior dental foramen is located about 1 cm. above the occlusal plane of the molar teeth. In the child of 7 years, this foramen is found about the level of the occlusal plane, the location changing gradually, until adult life is reached.

TECHNIC OF INJECTIONS

We have learned from a study of the anatomy that it is not necessary to employ conduction anesthesia in a child, except, at times, for operations on parts supplied by the mandibular division of the trifacial nerve. Therefore, the only injections which we will discuss will be those for infiltration anesthesia and the mandibular injection.

It is necessary in all cases, prior to making an injection, to talk to the child quietly and candidly, explaining our actions and the sensations that he will experience, drawing particular attention to the fact that he will feel us working and pressing, but that there will not be any pain. The area of insertion is then dried and sterilized by an application of iodine or some other substance and the injection made.

Of the upper teeth, the incisors and bicuspids are easiest to anesthetize; next, come the cuspids, and lastly the molars.

To anesthetize the upper incisors and bicuspids, the needle should be inserted midway between the gum margin and the apical region. For the cuspids, the needle should be inserted slightly higher, and, for the molars, it should be inserted a little anteriorly to the mesiobuccal root, being forced backward and upward to a point slightly higher than the apices of the roots. The needle should be inserted to the periosteum with the bevel toward the bone and a drop or two of the solution injected as we proceed, until the apical region is reached. Here, injection is made slowly, the operator moving the syringe slightly back and forth to avoid injecting into a vein. From 1 to 2 c.c. of the solution is deposited in this manner. After from five to ten minutes, anesthesia occurs in the outer nerve loop of the tooth injected.

The alveolar process and the soft tissues of the palate are supplied by the inner nerve loop of the maxilla. Therefore, to anesthetize these tissues, a second injection must be made. For this, we insert the needle at the gingival margin, continuing it parallel with the process, and inject from 0.25 to 0.5 c.c. into the submucous tissue. Anesthesia occurs in the same length of time as in the buccal injection.

The procedure for infiltrating in the mandible is similar to that in the maxilla. It may be well to note that, as an adjunct to the regular injection in the molar region, an additional injection into the

crests of the alveolar process between the teeth may be made.

Previous to making a mandibular injection in a child, the approximate width of the ramus should be determined by placing the thumb on the anterior border and the index finger on the posterior border. This enables us to locate fairly accurately the inferior dental foramen, which is midway between the anterior and posterior borders on the inner side of the ramus, level with the occlusal plane of the molars. At the same time, it helps to determine whether it is necessary to use a 42 mm. needle or a shorter one.

The area is sterilized in the same manner as for infiltration. For the right side, the tip of the thumb is placed between the internal and external oblique lines, while the fingers grasp the body of the mandible and the posterior border of the ramus outside the mouth. On the left side, the left arm is placed around the patient and the index finger is used to locate the internal and external oblique lines. The thumb is placed on the posterior border of the ramus and the other fingers along the body of the mandible. The needle is inserted on a line with the occlusal plane and close to the fingernail, and the point carried to the inferior dental foramen, where the solution is deposited. If it is desired to anesthetize the lingual nerve also, deposit one third of the solution midway between the inferior dental foramen and the mucous membrane. The long buccal nerve can be anesthetized, if necessary, by injection into the mucosa of the cheek just below Stenson's duct, the needle being forced backward toward the ramus.

After the injection has been made, a period of about ten minutes should elapse before starting the operation. In this time, the parts should be completely anesthetized.

To be successful in the use of local anesthetics, the operator must observe carefully every detail: the type of patient, preparation of the solution, selection of the needle and the technic of the injection.

As we have studied the various types of patients previously, we will not consider the subject farther, except for the sake of emphasis, to say that many a seeming failure has not been due to the lack of anesthesia, but to the use of an unsuitable anesthetic for the individual patient.

The solution at the time of injection should be warm, approximately blood temperature. If too hot or cold, injection into the tissues is painful.

The needle should always be sharp. The duller the needle, the more pressure required to insert it into the tissues, and, consequently, the more painful it is to the patient.

Failure to induce perfect anesthesia by the infiltration method is frequently caused by too rapid injection. If the solution is forced into the tissues too rapidly and under too great pressure, it injures them to the extent that the drug is not absorbed properly. The oral mucosa occasionally is found to have so little resistance that it tears under the slightest pressure. This causes a loss of solution and, of course, failure to obtain anesthesia.

It is absolutely imperative that time for the drug to become effective be allowed before starting the operation. Too rapid operating is probably the cause of most of the failures in local anesthesia in children.

In making a mandibular injection, the variance in the location of the inferior dental foramen between the adult and child must be borne in mind. If the injection is made in the same manner as that for an adult, the solution is deposited too high and does not reach the nerve trunk.

Local anesthesia has a large field in the practice of dentistry for children, if judiciously used and if the proper technic is followed.

SURGICAL TREATMENT OF PERIODONTOCLASIA*

By OLIN KIRKLAND, D.D.S., Montgomery, Ala.

OWING to the infectious nature of pathologic lesions involving the periodontium, and the danger of bacterial absorption because of their location in tissues so abundantly supplied with blood vessels, this type of infection is now regarded by students of pathology as of grave importance. Such infections are believed to be the cause of a variety of painful and disabling diseases.

With the development of asepsis in the practice of medicine, the eradication of disease through surgical measures has been greatly advanced, and, as a consequence, the span of human life has been extended by many years.

The treatment of periodontal disease by surgical procedure does not differ in principle from surgery as it is utilized for the eradication of infective foci in other parts of the human body.

Within recent years, notable progress has been made in the surgical treatment of oral disease, and there is available an abundance of clinical evidence that surgery of a more or less radical nature is indicated in the treatment of chronic suppurative inflammation of the periodontium. Its employment for this purpose has long since passed the experimental stage, and there is no longer any reason that anyone skilled in the practice of dentistry and who wishes to employ surgical methods in treating periodontal disease should not do so with every assurance of success, provided the operator has equipped himself with the necessary armamentarium, acquired a knowledge of the principles of surgery and familiarized himself with the surgical methods now in use.

HISTORY

The first efforts to cure the disease causing "loose teeth, shaking teeth, and bleeding gums with their discharge of corruption" reaches back into the dim ages of history.[1] The methods of treatment used in ancient times were based on therapeutics, and this practice was continued in use throughout the intervening ages, until about the time of Fouchard, the eminent Frenchman who is recognized as the father of modern dentistry. In the year 1723, he is credited with the statement that "little or no care as to the cleanliness of the teeth is ordinarily the cause of all the maladies that destroy them."

In the year 1757, M. Bourdet[2] described surgical treatment bearing a strong resemblance to the method now known as gingivectomy. He suggested that a cautery be used first, in case of

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 8, 1933.

1. Merritt, A. H.: Brief History of Periodontology, J. D. Res., 3 (soc. proc.) (Dec.) 1921.

2. Blanquie, R. H.: D. Cosmos, 73:607 (June) 1931.

failure to be followed by "cutting away the gingivae along the two sides of the pocket, terminating in the form of a triangle to the depth of the lesion." Anesthesia was unknown at that time, and, as a consequence, M. Bourdet referred to this method as a very painful procedure.

"In a small book published by Kunstman in the year 1772, he claims to have made a set of instruments to remove subgingival calculus, and stated that at times he resorted to gum resection.

"Serre, at about the same time, makes the statement that if the entire pocket is cut away, and the root cleaned the incision will heal promptly."

It is an interesting coincidence that Robitsek was advocating the gingivectomy operation in Europe at about the time Riggs was making periodontal history in America. The development of modern methods in surgical treatment being used today in the treatment of periodontal disease has been largely due to the activities of these two men.

Information gained from these retrospective glimpses into dental history clearly indicates that the methods known as gingivectomy and subgingival curettage came into use at about the same time; but it is obvious that prior to 1862 neither of them had advanced to any marked state of development.

GINGIVECTOMY

"The surgical method known as gingivectomy appears to be the oldest form of surgery to treat periodontoclasia, having been employed by Robitsek of Vienna in the year 1862. As the name suggests, the operation consists in cutting away the gingivae, the object being to remove all the diseased gum tissue that covers disease."[3]

3. Zemsky, J. L.: D. Cosmos, 68:465 (May) 1926.

G. V. Black was the first to practice gum resection in this country, being followed by Arthur D. Black, Ward, Kiser, Crane and Caplan, McFarland and others.

The gingivectomy technic has been made practical through the perfection of instruments, and the development of a surgical cement used as a postoperative dressing.

CONSERVATIVE SUBGINGIVAL CURETTAGE

In the year 1867, John M. Riggs[1] demonstrated in a clinic at Northampton, Mass., a new method of treating pyorrhea. "It is described as a rather thorough curettement of the alveolar process, and removal of calculary deposits upon the roots of affected teeth. Thorough curettement of the alveolar process formed a prominent feature in the treatment, and as practiced by Riggs, made of it an heroic operation."

Levi C. Taylor, an associate of Dr. Riggs, says: "He was very rough, and seemingly harsh, but for all that, he produced the best results in his bad cases. His treatment was so severe that he would place his patients under chloroform far enough to do his work satisfactorily."

It is claimed by some writers that Riggs followed the gingivectomy technic. This is denied by other authorities who claim that he practiced the method known as conservative subgingival curettage. Dr. Riggs contributed little to dental literature and, as far as we know, failed to provide an accurate description of his method of treatment. Consequently, some doubt exists as to which of these methods he actually did follow. Be that as it may, we are convinced from information obtainable that his treatment was very drastic, and that whatever it may

have been, we are justified in classifying it as a radical procedure.

Merritt says: "To Younger should be due the credit for taking up the work of Riggs, and for carrying it to its logical conclusion. He followed the principles laid down by Riggs, but his technique was more refined, and he placed less emphasis on curettage of the alveolar process."

It occurs to me that the changes suggested by Younger in his refinement of Riggs' method should entitle him to full credit as the original advocate of the technic known as conservative subgingival curettage. The Younger method needs no further description here, as dental literature is replete with articles covering every phase of this subject. Contributions have been made from time to time by T. Sidney Smith, James, Merritt, Spalding, Towner, Hirschfeld and others.

RADICAL FLAP OPERATION

The flap operation,[3] the latest surgical method to be used in the treatment of periodontal disease, like gingivectomy originated in Europe. It was first described in the year 1915 by Robert Neuman, of Berlin, who claimed to have practiced the flap operation since 1912.

Widman described the flap operation about the same time, and he also claimed credit for its origin. "This operation consists in making two incisions parallel to the long axis of the teeth, starting at the gingival margin in the interproximal spaces, and carried apically. Having separated the labial or the buccal muco-periosteum from the lingual by cutting through the festoons, the flaps can be raised. The field of operation is open to view, and the etiologic factors may be completely removed. The flaps are coaptated and sutured, the wounds are dressed by packing strips of iodoform gauze into the inter-proximal spaces."

In the year 1918, the first radical flap operation was performed in this country, by Zentler.[4] He was also the first to describe this method in American literature. His example was followed later by Nodine, Zemsky, Berger and others.

MODIFIED FLAP OPERATION

Having seen Dr. Zentler perform a radical flap operation,[5] I was favorably impressed with the soundness of principle upon which the technic was founded. However, after some unpleasant postoperative consequences in following this method, I concluded that the radical flap operation could be modified and still give equally satisfactory results. With clinical experiments following a less drastic retraction of the mucoperiosteal flaps, we observed excellent results, with comparatively little postoperative trauma or discomfort to the patient.

The modified flap operation consists in the separation or division of the interdental gingival papillae by making an incision through its center, passing a narrow bladed knife in either a mesial or distal direction and dividing the festoons into two small mucoperiosteal flaps, one being lifted lingually and the other labially or buccally, to a point slightly beyond the depth of the lesion. With a clamp fork, the mucoperiosteal flaps may be opened wide enough to insure free movement of instruments, and provide an unobstructed view to the field of operation. Using spoon-shaped curets, the pathologic granulation tissue may be loosened and trimmed out with small shears; after which the pocket is washed out with physiologic sodium chloride solution and

4. Zentler, Arthur: Different Forms of Gingivitis, Including So-Called Pyorrhea, D. Items Int., 12:175 (Feb.) 1919.

5. Kirkland, Olin: Modified Flap Operation in Surgical Treatment of Periodontoclasia, J.A.D.A., 19:1918 (Nov.) 1932.

sponged dry. The entire field of operation is now open to view, and the exposed roots and diseased bone may be thoroughly and expeditiously curetted.

I should not recommend the treatment of more than one fourth of the mouth at a time, with intervals of a week or more between operations.

Perfect hematosis is desirable in operating; therefore, in addition to the use of sponges, an aspirator will be found helpful in keeping the field of operation dry and free from the annoyance of blood and saliva.

For final inspection, the wounds are washed with physiologic sodium chloride solution, and thoroughly dried. Any deposits remaining on the root surfaces are exposed to view, and may be removed without difficulty. All pathologic conditions having been eliminated, the flaps are co-apted and sutured through the interdental spaces with one suture to close each pocket, using small curved needles and 0000 fine dermal sutures. If the technic has been correctly followed, the sutures should be the only visible evidence of an operation.

In order to stimulate the tissues surrounding the field of operation, rolled cotton packs dipped in hot sterile water are employed, being folded in a clean towel in order that some of the excess water may be squeezed out. After being cooled sufficiently to be tolerated by the mucous surface (to avoid blistering), a roll is placed on each side of the teeth, covering the operative area, and held in position till the heat subsides. These applications may be repeated several times.

After thorough drying of the teeth and gums, a sterile wax dressing consisting of three parts beeswax to one part sticky bridge and crown wax is fused in a crucible, such as a procaine dissolver, and painted over the field of operation, with a camel's-hair brush.

The sutures are removed in five or six days, during which time the patient is kept under observation, the dressing being changed every second or third day. After a week or ten days, the dressing may be left off, and tooth-brushing resumed with gentle force, which is to be increased as the gums become firm, resistant and healthy.

POSTOPERATIVE TREATMENT

Charters' method of brushing is preferred because of its stimulating effect on the gingivae. Brushing should be supplemented by the use of tape in the interdental spaces, and stimulation may be further aided by the use of round, tapering hardwood toothpicks, employed with pressure on the gingival papillae filling the interdental spaces.

In order that we may feel assured that reinfection has not occurred, and that the teeth and gums are receiving attention as directed, it is advisable to see the patient frequently for a period of at least four weeks. After this, semiannual visits are suggested for prophylaxis and inspection, the occlusal relationship of the teeth being noted at such visits.

Cooperation of the patient is essential to success in following this technic, as in all other methods of treatment, and without it failure is almost inevitable.

The radical and modified flap technics are based on the same general principles. There are two differential points of distinction: 1. In the radical flap operation, two incisions are made, starting at the gingival margin and carried apically to a point near the end of the root. These incisions provide for the lifting of an extensive flap; whereas, in the modified flap operation, the two incisions are not used, and the extensive flap, which increases trauma, with its consequent pain and swelling, is unnecessary. Instead, a much smaller flap is used, and thus con-

siderable postoperative discomfort is avoided. 2. In the radical flap operation, healthy bone in close proximity to the diseased area is trimmed to a point parallel to the depth of the lesion; whereas, in the modified flap operation, this healthy bone tissue is conserved and utilized as a matrix to aid in the building of new bone tissue in the process of repair. This additional bone support provides the teeth with a stronger foundation, and at the same time, there is a more pleasing esthetic result.

With more than twenty-five years' experience in the exclusive practice of periodontia, many of which have been spent in developing the modified flap operation, I have arrived at the following conclusions: Periodontoclasia will respond to treatment when effective measures are used and the patient is cooperative. 2. The early symptoms of the disease will respond readily and completely to a simple method of treatment. 3. The chronic suppurative pus pocket of long standing, having reached an advanced state of development, will not yield to treatment by simple measures. It does respond to a more radical surgical technic providing for free access of instruments and an unobstructed view to the field of operation. 4. In either the early manifestations of the disease or its subsequent stages of development, there may be recurring foci of infection. By the same thoughtful care and attention to this disease as that given to caries of the teeth, the periodontium may be maintained in a satisfactory state of health throughout the normal span of life. 5. There are but three effective measures in use in the treatment of periodontoclasia: (*a*) gingivectomy, (*b*) subgingival curettage and (*c*) the flap operation.

There is merit in each of the three methods used to treat periodontoclasia, and each of them fills an important place in the practice of periodontia; therefore, I wish to emphasize the importance of using them in combination, employing each method according to its indications, whenever, and wherever it may be used to the best advantage. The character of the lesion, and its location in the mouth, should be the determining factors in selecting a technic.

The greater number of teeth, by far, that come under our care are not involved in advanced stages of periodontoclasia. On the contrary, it is an exception to the rule that examination reveals an advanced tissue resorption around every tooth in the mouth. As a general rule, we find a deep pocket here and there, with a number of teeth in the same mouth exhibiting, perhaps, a little evidence of disease, but slight, if any, destruction of the epithelium lining the gingival crevice.

The early symptoms of periodontal disease demand treatment, but not the form of radical surgical treatment indicated in chronic suppurative pus pockets of long standing. If teeth can be successfully treated by a simple, painless method, such as conservative subgingival curettage, they should never be treated by a radical surgical technic. For instance, we often see cases wherein only one or two definite pus pockets exist in the entire mouth, the remaining teeth exhibiting nothing more than a little gingival inflammation. In such instances, we should treat the one or two pus pockets surgically, and the remaining teeth by the conservative subginval curettage method.

Restoration of the periodontal tissues to a state of health is the objective in the treatment of periodontal disease; therefore, a safe, sane, painless and dependable method should be sought out and recognized as standard. I believe that such a standard has been here outlined.

RAW BASIC FEEDING IN THE PREVENTION AND TREATMENT OF DENTAL CARIES

By I. NEWTON KUGELMASS, M.D., Ph.D., Sc.D., THOMAS B. KING, D.D.S., and CHARLES F. BÖDECKER, D.D.S., F.A.C.D., New York City

DENTAL caries is the cost of civilization to the child. It is rare among primitives, but becomes rampant on contact with civilization. It rises during growth and sinks with maturity. It advances with refined living and is not arrested by any one of the current methods employed, dental or medical. Dental decay is widespread among all peoples, urban and rural; among all classes, rich and poor; in all bodily states, general health and systemic disease. Its universality has thus far defeated attempts at recognition of any one determining factor that is productive of dental decay. Because the dental studies of several centuries have been needlessly confined to teeth as entities distinct from the body that bears them, they have failed to arrest the progress of this most prevalent disease in civilized communities. The tooth may be an end organ, but it, even to the dentin, still has a vascular and lymphatic relationship to the rest of the organism, so that its life course cannot be determined by local conditions alone.

Studies of systemic conditions have more recently stressed tooth development particularly from the standpoint of the newer knowledge of nutrition with due credence to the formation of the anlage or to the dental environment in caries. Teeth are in the first line of defense in the transition between environmental offense and systemic resistance. But in comparison with other tissues of the body, they are slow to yield to disturbance, deciduous teeth reflecting damage three years after its onset, and permanent teeth over six years after dental disturbance. Studies on dental decay must necessarily invite both dental and medical cooperation simultaneously in both clinical and experimental evaluation of the factors operative in their destruction.

Dental caries is a syndrome of many systemic and local disturbances rather than a simple disease from a single source. Advocates of the theory that any one local or systemic condition determines the nature of the process have few adherents. The etiologic status of dental decay must not only satisfy the observations of any one investigator but must fulfil all the criteria of dental decay observed among all peoples and races, among the primitives and civilized, and among the growing and mature. Such final etiologic interpretation must explain why clean teeth are subject to rapid and recurrent decay and yet a mouth offensively dirty is not infrequently free from decay; why aciduric and acidogenic bacteria are found in active carious cavities, and yet not all the susceptible areas in the mouth become carious, though all are exposed to the same bacteria; why one tooth may be proximal to an area of caries and not be affected; why carious lesions suddenly become arrested and re-

main so indefinitely without change in regime; why a break in the continuity of the enamel is in some a requisite for decay and in others all the teeth may be abraded and the dentin widely exposed without evidence of caries; why some teeth are well formed and yet carious and others are badly calcified and yet not carious; why some develop caries on a vegetarian dietary and others on a carnivorous, and almost all on a mixed dietary; why caries is less prevalent in institutionalized children on the meager minimal dietary than in the well-to-do households on the so-called luxuriant diets under supposed medical supervision.

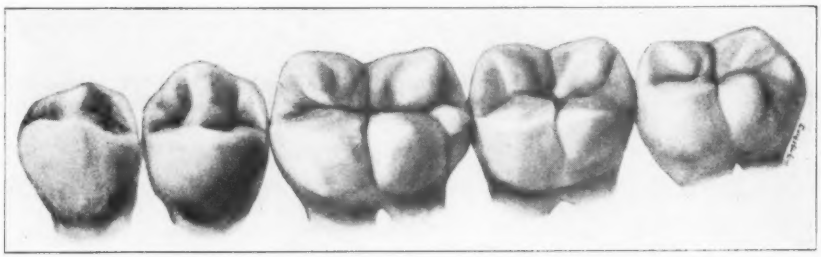

Fig. 1.—Left lower posterior teeth; showing caries susceptible areas.

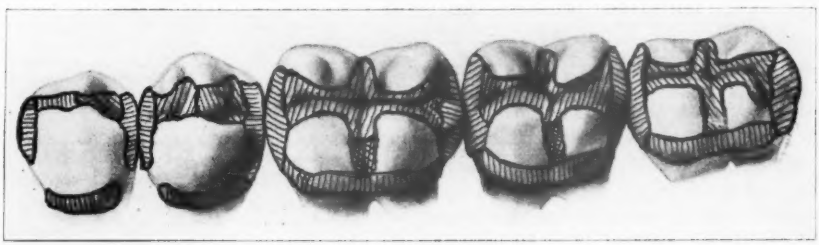

Fig. 2.—Twenty-four caries susceptible areas containing fillings in left lower posterior region, resulting in caries index of 15 per cent for these teeth alone.

We have come upon some striking observations of arrest in dental caries in the course of repeated routine examinations in children studied during the past five years. With the advent of viosterol, we have been among the first to appreciate that an adequate supply of calcium and phosphate in the diet is indispensable for actual bone and teeth formation, since viosterol merely influences their absorption and utilization of the daily dietary. Our study of the relative values of acid and base forming diets in the metabolism of rats has definitely demonstrated that a preponderance of alkali-forming minerals is indispensable in growth and development as well as in the prevention of rickets. Similar observations were made in infants and children convalescing from various disturbances. We have since been able to accelerate convalescence and buoy up the development progress of undernourished children by the daily administration of base-forming dietaries abundant in milk, fruits and vegetables to the extent that each meal was definitely base-forming in content. Such formulation of the child's dietary on

the basis of its total acid-base content is in accord with the actual composition of the child's tissues, which, during growth, always contain an excessive amount of alkali.

Continuous administration of such a dietary regime accelerates the child's rate of growth, its development, metabolism and activity, which are in striking contrast with those of children maintained on acid-forming dietaries. It was incidental to these early studies that arrest of caries was observed in children maintained on base-forming dietaries, but it was not until a raw base-forming dietary was instituted in the study of anorexia in certain children that more striking arrest of dental caries became apparent in the repeated routine examinations of these children. The metabolic significance of the base-forming dietary in dental development and the "raw" factor of foods in their relation to primitive dietaries that are protective against dental caries lead us to a more extended study of this relationship. Our qualitative observation of the number of carious teeth gave way to the quantitative calculation of the index of dental caries devised by one of us (C. F. B.).

THE INDEX OF DENTAL CARIES

Heretofore, an estimate of the degree of dental destruction from caries in man has been made only roughly. As long as the prevention of this disease was regarded as being possible solely through oral hygiene, exact statistics on the activity and distribution of dental caries were not considered necessary. Now, with

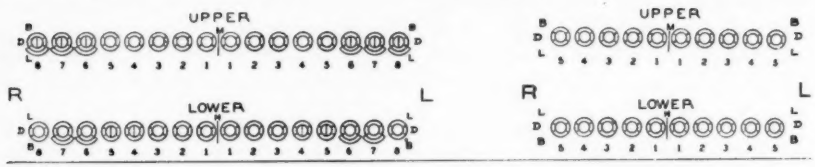

Fig. 3.—Chart of deciduous and permanent teeth used at Columbia University Dental School, Department of Oral Hygiene. This chart shows the number of caries susceptible areas on each tooth.

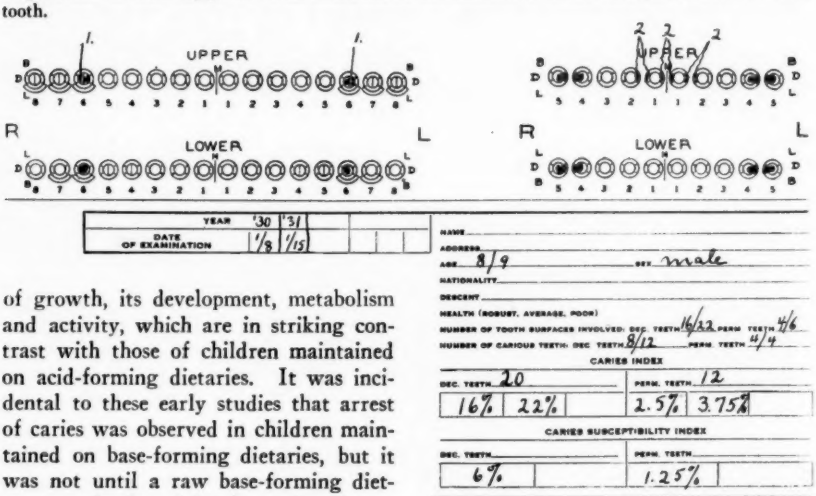

Fig. 4.—Chart containing data of two dental examinations (Jan. 8, 1930 and Jan. 15, 1931) showing increasing caries indices of deciduous and permanent teeth as well as their caries susceptibility index.

more and more evidence that some systemic condition or conditions may augment or retard the activity of dental caries, it is essential to obtain exact data. We must have figures to show the average amount of dental destruction in males and females of different ages; and, even more important, we must know the rate of progress of this disease for each patient. Evaluation of the degree of dental destruction should become part of the routine practice of clinical dentistry. A great number of cases are necessary to ascertain the average degree of dental destruction present in children and in adults. To this end, a uniform type of tabulation, or caries index, seems required.

TABLE 1.—DEVELOPMENT OF DENTAL CARIES WITH AGE

Age (Years)	Life Caries Index Average for Age		No. Cases
	Deciduous	Permanent	
4	3	....	13
5	15	....	11
6	18	0.75	15
7	10	2.77	6
8	15	3.02	12
9	12	4.04	8
10	10	3.77	15
11	3	5.15	9
12	7	5.32	6
13	5	5.12	2

TABLE 2.—DEGREE OF DENTAL CARIES AND INCIDENCE OF ORAL INFECTION

Life Caries Index	Acute			Chronic		
	None	Mild	Severe	None	Mild	Severe
0	1	2	3	1	3	3
0-15	7	16	6	7	14	9
15	4	4	6	4	11	10

The teeth of human beings have an average of five areas, of varying susceptibility to dental caries, a total of 160 areas for the thirty-two teeth. In order

to estimate the percentage of tooth surface destruction, a table of figures was set up giving a 100 per cent dental caries index when all of the 160 areas are affected by decay. Eighty affected areas give a 50 per cent caries index; one area gives an index of 0.625 per cent.

No table of figures is needed to compute the caries index of the deciduous or temporary teeth. These, being twenty in number, each having five surfaces, give a total of 100 surfaces. Thus, the number of involved areas of the deciduous teeth may be expressed on a percental basis (sixteen involved surfaces equal a sixteen per cent caries index).

A sketch of the left lower posterior teeth (Fig. 1) shows that each tooth may have five or six caries-susceptible areas. Assume that in a caries-ravaged mouth (Fig. 2), twenty-four of these areas have been filled: this would indicate a caries index for these five teeth alone of 15 per cent. The number of fillings would not necessarily be twenty-four, because often one filling involves two or even three surfaces of the teeth. In order to calculate the caries index, the number of *areas* involved should be counted, and not the number of fillings. The fillings here indicated are comparatively small (Fig. 2), a condition that exists only in patients who have had constant dental care. If caries has been rampant, these teeth would show even less tooth tissue than indicated and more filling material.

To simplify the charting of the teeth and to ascertain quickly the caries index of each person, the diagram in Figure 3 is suggested. This shows the thirty-two permanent teeth at the left, and the twenty deciduous or temporary teeth at the right. This form is used to chart

TABLE 3.—DESCENT AND DEGREE OF DENTAL CARIES

Life Caries Index 0%	No. Cases	L. C. I. 0-15%	No. Cases	L. C. I. 15%+	No. Cases
American	6	Italian	30	Italian	16
Puerto Rican	3	American	9	Puerto Rican	6
Italian	3	Puerto Rican	5	American	4
Portuguese	1	Irish	4	German	3
		Scotch	1	West Indian	2
		French	1	Czechoslovakian	1
		Russian	1	Finnish	1
		German	1	Greek	1
				Lithuanian	1
Total	13	Total	52	Total	35

TABLE 4.—DENTAL CARIES AND KETOSIS

Case	Age Years	Descent	Life Caries Deciduous	Index Permanent	Duration of Diet Months
Acid Forming Ketogenic Diets					
H. M.	10	German	19	5	6
H. L.	10	German	7	5	8
L. P.	7	French	17	5	12
R. V.	9	American	25	5	18
J. K.	8	American	23	3.7	12
J. M.	10	Italian	21	5.8	12
L. D.	5	Italian	14	0	5
E. C.	11	American	24	3.1	18
D. E.	11	American	8	4.3	24
P. H.	10	Irish	9	1.5	6
G. O.	16	American	4	28.1	36
Base Forming Ketogenic Diets					
G. R.	12	Italian	0	0	6
D. M.	10	Puerto Rican	0	0.06	12
J. R.	7	American	0	0	3
W. M.	4	Portuguese	0	0	5
F. J.	12	American	5	0	24
L. S.	12	Russian	5	6.8	24
T. P.	11	Italian	2	2	24
F. J.	8	Irish	1	5	8
S. L.	9	American	0	1	6
R. C.	6	American	0	1.2	6

the dental conditions of school children by dental hygiene students. Its purpose is principally to calculate caries indices of large groups. If such charts were to be used in conjunction with hospital records, the question on health would naturally be omitted.

Figure 4 shows the manner in which these charts are filled in. Two separate caries indices must be set up, one for the deciduous, and one for the permanent teeth. Otherwise, a child of 6 years having a high index as a result of a severe involvement of the deciduous teeth, would have a lower index at 14 years of age, when these teeth are lost. This is, of course, an impossibility, for a decayed tooth cannot again become perfect.

Two dental examinations (Fig. 4) of the same boy were made on Jan. 8, 1930, and Jan. 15, 1931, respectively (aged 8 and 9). Originally, the number of involved surfaces of the deciduous teeth (right diagram, heavily inked carious areas) were sixteen. These were distributed on eight teeth; giving a caries index of 16 per cent for the deciduous teeth. At the same time, the permanent teeth had four involved surfaces on four teeth; giving a caries index of 2.5 per cent for the permanent teeth.

Approximately one year later, the number of involved surfaces of the de-

TABLE 5.—ANALYSIS OF DIETARIES OF RACES IMMUNE TO CARIES

Race	Daily Foods	Dietary Properties
Maori.....	Kumara (sweet potato), raranhe (fern-root), taro (vegetable), bread (bulrush pollen and hinantree berries), huê (pumpkin), berries, jellies (seaweeds), fish and birds (delicacies)	Masticatory, raw and steamed variety, alkali forming
Eskimo.....	Fish, seal, walrus, white whale, birds, berries, reindeer moss, plants (20 kinds)	Raw, masticatory, acid forming.
Lapp.....	Milk, sorrel, butterwort (plants)	Raw and steamed, masticatory, alkali forming
Indian.....	Fish, roots, grasses, fruits, nuts, berries, maize, potatoes, sugar-pine	Raw, masticatory, alkali forming
Fuegian.....	Fish, dried fungus (mushroom)	
Fijian.....	Fish, opossum, pigs, yams, taro, bananas, cocoanuts, sugar-cane	Raw and steamed, masticatory, acid forming
Papuan.....	Kumara, sago, beans, game, cabbage leaves	Raw and steamed, masticatory, alkali forming
Malay.....	Yams, roots, fruits, rice, maize, bananas	Raw and steamed, masticatory, alkali forming
Jakun.....	Fruits, rice, kulim-leaves (onions), wild ginger, tapioca	

ciduous teeth had increased by six (marked 2-2-2), making a total of twenty-two surfaces in twelve carious teeth. The caries index of the deciduous teeth is thus raised from 16 to 22 per cent. The caries-susceptibility index, which shows the amount of dental destruction since the last examination is 6 per cent, index is 1.25 per cent, obtained as described above.

RESULTS

1. *Descent.*—The distribution of our preliminary study of 100 cases is given in Table 1. Children with a life caries index of 0 per cent were of the more stable elements of their race. They

TABLE 6.—DEGREE OF DENTAL CARIES AND DAILY DIETARY

Life Caries Index	Protein		Lipids		Carbohydrate		Acid	Basic	Calcium		Phosphorus		Vitamin A		Vitamin B		Vitamin C		Vitamin D	
	a*	d	a	d	h	a			a	d	a	d	a	d	a	d	a	d	a	d
0	13	0	13	0	5	8	1	12	11	2	13	0	13	0	11	2	11	2	13	0
0-15	52	0	52	0	7	45	17	35	42	10	35	17	50	2	25	27	45	7	30	22
15	33	2	35	0	6	46	26	9	22	13	26	9	34	1	18	17	27	8	13	22

*a, adequate; d, deficient; h, high

TABLE 7.—DEGREE OF DENTAL CARIES AND NATURE OF INFANT NUTRITION

Life Caries Index Per Cent	Duration of Breast Feeding Months				Vitamin Supplement				Mineral Content	
	0	1–3	3–6	6–12	0	C	D	C & D	Alkaline	Acid
0	1	2	3	8	2	6	–	6	10	3
0-15	2	8	4	3	11	14	1	13	18	26
15	6	5	4	2	12	13	–	10	6	30

obtained by subtracting the previous index from the present one (22 per cent —16 per cent=6 per cent). Decay of the permanent teeth has also progressed since the previous examination, six surfaces now being involved in the same four teeth. The caries index is thus raised to 3.75 per cent. The caries-susceptibility

were all provided with base-forming dietaries containing an abundance of raw food, and their mouth hygiene was particularly noteworthy in comparison with that of the two other groups of children, revealing high indices of dental caries. The studies of dental caries in various races revealed that those living in un-

civilized or natural conditions are relatively free from caries in comparison with modern races whose percentage runs as high as 95 per cent. In fact, the number of teeth affected with caries in each individual studied was far less in those leading natural lives than in those under the influence of civilization, the ratio being 2 per cent in the former to 50 per cent in the latter. Finally, it has been observed that the Maori race, subject to the influence of civilization for about 100 years at the very most, has shown a rise to 93 per cent in its incidence of dental caries, although the extent of caries in each mouth is comparatively low. Civilization *per se* is not so much responsible for the difference in the extent of caries, but more particularly the nature of the "civilized" dietary which the particular race has attained. Mouth hygiene was attained in no small degree even in uncivilized individuals by virtue of the hard usage of the teeth and jaws exercised in slow serious mastication to the point of being worn.

2. *Age.*—The incidence of caries in childhood increases rapidly with the age. The evaluation of the life caries index for both deciduous and permanent teeth at each age level from 4 to 14 years reveals this upward trend in dental decay. The relatively low caries index for the deciduous teeth at 4 becomes markedly increased at 5 and reaches its peak at 6. Then, the relatively low life caries index for the permanent teeth steadily rises until its peak at pubescence. With this increase in caries of the permanent dentition, there is, of course, a slow decrease in the decay of the deciduous teeth. Not only does the number of carious teeth increase, but there is also evident a more deeply seated involvement of the disease in each tooth examined.

Caries of the deciduous teeth is extensive and too prevalent to have been ignored in the periodic supervision of early childhood. The age range of the children under our observation has been up to 14. The involvement in dental caries is not nearly so extensive as that reported for adolescence. Our observations reveal a peak of caries for deciduous teeth at 6 and another peak of caries for the permanent teeth at 12. Other observers have recorded a peak of caries for adolescence at 20. This rhythm in the incidence of caries parallels that of development, thus relating both to deep-seated metabolic changes in the growing body.

3. *Oral Infection.*—The great prevalence of mouth and upper respiratory infections in children parallels somewhat the extensiveness of dental caries during growth and development. Both offenses abate with maturity. A study of the various factors in the development of dental caries, the relative occurrence of various types of such infections, was determined for a possible relationship to either the production or maintenance of dental caries. Children of each of the three groups, of no, moderate and extreme caries, suffered from all kinds of infections, acute and chronic, mild and severe, at all ages. Although the small group of children with no dental caries show less periodicity of upper respiratory infections, the occurrence of severe mouth and upper respiratory infections for prolonged periods of time in some did not affect the integrity of their teeth.

Two of the group with a light caries index of zero were hemophilics under my observation for several years. One showed an extensive chronic sinusitis with periodic cervical lymphadenitis, the other showed markedly hypertro-

phied and diseased tonsils meeting in the midline; yet in neither case did the chronicity of infection proximating the teeth affect them in the least. The hemophilia in these boys prevented surgical clearance of these infections, incidentally giving us an indication of their possible relation to dental decay. The acidosis associated with each of the infections which befell the children with no dental caries was necessarily transient enough to make no lasting destructive effects on the teeth. Our attempts to relate any type of infection in the region of the teeth with their possible destruction has led to no positive correlation.

Aciduric and acidogenic bacteria have been found in active carious cavities, favoring the fermentation of carbohydrate to lactic acid. Their acid formation gradually dissolves enamel under the films or plaques covering the teeth. The presence of *Bacillus acidophilus* in its various forms in the mouths of the susceptible and the immune, respectively, is, according to Bunting, the most consistent difference observed between these two groups. While we have studied the oral flora of children with and without caries, we have observed no differences in their teeth as far as all other types of infectious involvement about the teeth are concerned: fusospirillary infections, streptococcic tonsillitis, tuberculous adenitis, chronic sinusitis, pharyngeal abscess formation, gingivitis, acute contagious disease, etc.

4. *Infant Nutrition.*—The nature of the infant's dietary affects the incidence of dental caries. A study of children's dietaries during the first year of life in relation to those of children who were caries free, as well as those who had extreme caries, showed no single nutrient as the determining factor either in the prevention or in the production of dental caries. Most of the children observed have had the infant dietaries supervised in the same institution, and so available records were resorted to in these comparative studies. Breast-fed infants showed no greater freedom from caries than those artificially fed. In fact, there appeared no relationship between the duration of nursing and the development of caries.

Children free from caries were either artificially fed or breast-fed, and children with extensive dental decay showed similar distribution in the type of early feeding. Even prolonged breast-feeding far into the second year of life in some of the Italian infants produced no immunity to caries. In this respect, severe dental caries was about as prevalent in exclusively breast-fed infants as severe rickets or scurvy in these infants. The nutrition of the teeth is apparently better conserved during the prenatal than during the postnatal life. But breast milk does not contribute to the dental structure such a degree of nutritional protection. Just as breast milk of healthy mothers can be modified by antirachitic measures as regards the mother's dietary to assure that the breast milk with be antirachitic to the infant, so will it be possible to modify the breast milk in its protective effect as regards dental caries in the infant.

That breast milk is nonprotective as regards dental caries has previously been recorded by other observers. In a survey of 15,000 school children in England, Pedley found that caries was present in breast-fed children almost as much as in the artificially fed. Jones found that 85 per cent of Japanese infants in Hawaii showed a marked destruction of deciduous teeth in spite of the fact that 90 per cent of them had

been breast fed. Careful and periodic supervision of infants and children in the course of an active pediatric practice likewise reinforces this observation. We cannot assume that breast milk can contain destructive constituents in so large a racial group, but rather that some nutrient factor was inadequate for the maintenance of dental metabolism.

Development of the teeth begins in intrauterine life with deposition of lime salts in deciduous teeth at about the sixteenth week. The nutrition of the mother hardly influences the teeth of the fetus because embryonic tissue possesses considerable growth impulse, enabling it to remove the necessary growth constituents from the maternal structure. Even if the maternal diet is inadequate, the mother is more likely to be affected than the fetus, unless her dietary be extremely deficient for a prolonged period, when both mother and fetus necessarily suffer. The maternal organism can supply all nutrients but vitamins A, C, and D, which are not stored in sufficiency. It is only during nursing that the deficiency in these constituents is markedly reflected in the composition of the breast milk. If these vitamins were the determining factors, the structure of the permanent teeth might be involved. Thus far, clinical evidence is lacking that these vitamins necessarily dominate dental development in infancy.

The children found free from caries received no greater vitamin supplements than did those with marked caries. The distribution of those who received adequate intake of vitamin C as well as D are about the same in each of the three groups of no, moderate and extreme caries. The addition of orange juice or cod liver oil appears to be unrelated to the degree of dental caries in each of these groups. Children with rickets in infancy showed no more marked degree of caries than those who were free from rickets. In fact, a number of the mothers of those infants who showed dental caries received adequate doses of cod liver oil during the last two to three months of pregnancy as part of their prenatal supervision. Two of the fourteen children free from caries had both clinical and chemical evidence of rickets in infancy, while relatively larger numbers of those who had dental caries were clinically rachitic in infancy. From our careful observations of 100 cases studied for dental caries, 20 per cent gave evidence of rickets in infancy, but no relationship can be established between the occurrence of rickets and the subsequent development of dental caries.

The children whose life caries index was zero were all maintained on a base-forming dietary in infancy. In addition to the breast or artificial feeding, they were offered, beginning with the first months of life, daily additions of stewed fruits, fruit juices and banana, vegetable puree and potato, two to four times daily, and, in addition, a single portion of acid-forming cereal. These children were among the first to have been given the advantages of early semisolid feeding in the first months of infancy, primarily for the maintenance of an alkali-forming regime consistent with calculated mineral requirements during growth. Four years ago, we summarized work that had been in progress since 1926, indicating that standard infant dietaries were acid-forming, contrary to the composition of the child's body and contrary to requirements in each of the mineral constituents essential for growth. It was on this basis that early semisolid feeding was instituted in the first months of life, to bring mere milk and carbohydrate intake to the requisite levels of mineral requirement.

Our studies of the infant dietaries of the children with no caries reveal the base-forming factor in the dietary as the predominant one; in comparison with the two other groups showing moderate and extreme caries and who were maintained in infancy on a more or less neutral or acid-forming diet. While no single dietary constituent appears as the determinant as far as infant feeding is concerned in the evaluation of dental caries, the nature of the total mineral intake, acid-forming or alkali-forming, parallels the incidence of dental caries. Comparable to these observations appears the work of Jones indicating arrest of dental decay in Hawaiian infants after six months of constant administration of fruits and vegetables, in addition to milk.

5. *Dietary Factors.* — Comparative studies of the daily dietaries and the individual idiosyncrasies of children revealed nutritional factors related to the incidence of dental caries. Quantitative estimates of the daily food intake of the children hospitalized for weeks or months for chronic disturbances and subsequent follow-up at home by a trained dietitian offered comparative data regarding the dietary content of each of the children studied from the standpoint of dental caries. The current standards of daily requirement in each of the nutrients were considered as base lines for the determination of proficiency or deficiency in a particular nutrient or vitamin. The results of these determinations are presented for each nutrient in terms of the groups immune and susceptible, respectively, to dental caries.

Protein, lipid and carbohydrate: Both immune and susceptible groups showed no deficiency in any of these nutrients. Two of the children with extreme caries were allergic and were deprived of an adequate intake of milk and other sources of animal protein. The group immune to caries consumed a daily amount of carbohydrate no greater than 25 per cent of the total caloric intake and none showed what might be considered strikingly low carbohydrate intake for children. Seven of fifty-two with a moderate amount of caries consumed a relatively high amount of carbohydrate. On the other hand, six of those with extreme caries were maintained on abnormally high carbohydrate intake. Carbohydrate has been thus far heralded as a chief offender in caries because it ferments to lactic acid, which subsequently dissolves the enamel, but it also favors the formation of plaques under which caries takes place. Sugar itself does not produce caries, for tooth cavities have been filled with acidophilus organisms and sugar sealed tight without caries formation. Boyd and Drain were able to arrest dental caries in diabetic children on a low carbohydrate diet. But the sugar content of the children's diet was necessarily ruled out as the destruction factor in caries. They observed that children with celiac disease maintained on dietaries adequate in all respects, but containing relatively large amounts of simple sugars, responded as well as the diabetics as far as the arrest of caries was concerned. The Mellanbys continue to place particular stress on the carbohydrate content of the dietary in its relation to the formation of dental caries. We were led to conclude that the ill effects of high carbohydrate feeding are chiefly the result of the diminution in the dietary of more important nutrients rather than in the harmful effect of carbohydrate.

Vitamin A: Children, both the immune and the susceptible to caries, respectively, showed no dietary disturb-

ance in vitamin A content. In a subsequent study of the relation of vitamin A to infections in children, we have observed that neither the deprivation of vitamin A for several weeks nor the administration of excessive amounts of standardized carotene produced any change in the dental caries of these children. These clinical observations are contrary to those of Marshall observed in experimental animals. Apparently, there is a considerable gap in the applicability of experimental results in animals to human beings. Bloch's observations of Danish children with xerophthalmia revealed no dental caries related to this extreme vitamin A deprivation.

Vitamin B: Children with moderate and extreme degrees of caries showed a diminished intake of vitamin B complex; but it is important not to attribute the deficiency to this factor as directly causative of dental caries. This is particularly emphasized by the fact that dental caries is not a concomitant of beriberi or pellagra in countries where these deficiency diseases are endemic. Although the nature of the dietaries of the children with caries is such that vitamin B deficiency is a consistent observation, they are rather indirect in their causation of caries.

Vitamin C: Few children susceptible to caries showed any striking diminution in the daily vitamin C intake. We cannot attribute dental caries to lack of vitamin C, else the vast number of children with dental caries throughout the world are suffering from latent scurvy. The guinea-pig, most sensitive to vitamin C deprivation, shows microscopic lesions in the teeth as the first sign of scurvy; but these animal observations are not applicable to human beings. Hess observed no unusual amount of caries in children suffering from scurvy in infancy. Jones reported widespread caries in children in Hawaii, where tropical fruits abundant in vitamin C are the staple articles of food throughout the year. The Eskimos consume minimum amounts of vitamin C foods and yet their teeth are the best in the world. Hanke's observation that a pint of orange juice a day is protective as regards dental caries is, in the light of our present studies, interpreted not on the basis of this vitamin C content, but rather on its considerable alkali-forming content. In a sense, the observations of the Mellanbys of the caries-producing effect of carbohydrate may be interpreted in the light of this work as the result of its considerable acid-forming content in the dietary of growing children.

Vitamin D: The children of both immune and susceptible groups, respectively, showed no dietary deficiency in vitamin D, although the group free from caries was simultaneously free from rickets in infancy, and 20 per cent of the group with moderate or extreme caries had rachitic manifestations clinically or chemically, or both, demonstrable in infancy. On the other hand, the greater number of children with caries gave no clinical evidence of rickets during infancy and were given adequate amounts of cod liver oil daily in infancy, yet they developed a marked degree of caries in both the deciduous and the permanent teeth. We conclude with Hess that dental caries is not brought about solely by rickets, but rather that it is one of several etiologic factors. The Mellanbys have stressed the determining rôle of vitamin D in the production and in the prevention of dental caries in puppies as well as in children. In our group of children, rickets was a contributory but not the determining factor in the devel-

opment of dental caries. It must not be forgotten that rickets affects not only bones, but also the muscles, which by virtue of their hypotonicity eliminate the natural stimulus of development of the long bones as well as of the maxilla. Various observers have recorded brittleness and crumblyness of deciduous teeth, which have been seen only occasionally in our own experience in severe rickets. Others have observed defective formation of the permanent teeth, which, in our own group, we have been unable to relate, possibly because of the present rarity of severe rickets in our selected group of children with dental caries.

Minerals: Children free from dental caries showed consistently a dietary excessive in alkali-forming minerals. Children with moderate caries showed a deficiency in phosphate intake in their dietary. Well children with extreme caries showed a greater deficiency in alkali-forming salts and a preponderance in the acid-forming constituents of the diet. Paralleling the mineral character of the respective dietaries of these three groups of children was the preponderance of intake of raw fruits and vegetables in the caries-free group in comparison with occasional raw food intake in these observations that dental caries is a disease of mineral metabolism particularly disturbed during the peaks of rapid growth and development of childhood. These conclusions find strong confirmation in the work of Howe, Hess, Boyd and Drain.

6. *Ketosis.*—Most children who were maintained on base-forming dietaries containing ample amounts of raw base-forming foods at each meal were resistant to the development of dental caries. These conclusions have been further reinforced by a parallel study of epileptic children under strict dietary supervision for months at the hospital and for years at home. These young patients were treated with various types of ketogenic diets for the alleviation of their convulsive seizures. Examination of the life caries index of each of these children resolved them into two groups, one with low life caries indices and the other with very high indices; and these two extremes, representative of the relative degree of dental decay, paralleled very strikingly the nature of the ketogenic diets. It is to be remembered that all ketogenic diets produce chronic ketosis and dehydration in all bodily tissues and organs. Some of the ketogenic diets may be base-forming and others acid-forming in mineral intake and nevertheless both produce varying degrees of chronic ketosis. This necessarily is productive of some degree of systemic decalcification of bones and teeth. Those children maintained on a ketogenic diet whose mineral intake was acid-forming showed marked dental caries, while those children maintained on a ketogenic diet whose mineral intake was base-forming showed low life caries indices. Thus, we have confirmatory clinical and biochemical evidence of the rôle of mineral metabolism as it affects the course of teeth during growth and development.

7. *Dietaries of Immune Races.*—Absolute immunity to dental caries is nonexistent; but certain races reveal so little decay in comparison with its enormous incidence among civilized peoples that practical immunity may be claimed with good reason. Studies of the geographic distribution of disease furnish mass means of testing hypotheses. As the dietaries of primitive races are known, it is logical to determine the common basis, if any, for the relative immunity to caries. The diets of all "natural" races are much more varied than those

of civilized races. Although certain articles form the staple food in certain areas, in no case do they constitute the sole food of any race. Another feature besides variety in foods is sapidity. There is a constant inclusion of raw and steamed articles of food which have a direct stimulating effect on the salivary glands. This is common to dwellers in the arctic and equatorial regions, in the meat-eating and in the vegetarian tribes, in the low types and in the high types of uncivilized man.

Food most frequently used among all races immune from caries are alkaline-forming fruits and berries, balancing fresh fish and raw meat. Most of the dietaries are base-forming, while some are acid-forming, but both types in all races are complete in every nutrient factor and ever abundant in mineral requirement. A constant characteristic of all dietaries of races immune to caries is the minimal interference with food as obtained in its natural state. The greater portion of the food consumed whatever it be is necessarily raw or, at the most, steamed. Cooking of food in primitive races as compared with civilized parallels in a sense the minimal and extreme incidence of caries. Another striking property of primitive food is its masticatory value; and nearly all races relatively immune to caries show marked attrition of the teeth. This is not due to the coarse or gritty nature of the food, for native races are most careful in the preparation of their meals. Attrition is considered more probably due to the mechanical effect of eating fibrous particles, combined with the constant acid action of fruits and berries. Primitive dietaries bearing these characteristics are so definitely preventive of dental caries that a sudden change in the dietary habits of races for those preferred by civilized peoples is rapidly productive of caries.

CONCLUSIONS

1. Dental caries is a syndrome of many systemic and local disturbances rather than a simple disease of a single source.

2. Determination of the degree of dental caries was made by means of Bödecker's life caries index in children under continuous supervision for other systemic conditions.

3. Children free from dental caries were of the more stable elements of their race, whose general and mouth hygiene were superior to that of children with marked dental caries.

4. Dental caries is maximum at 6 for deciduous teeth and at 12 for permanent teeth, the incidence increasing rapidly with age. This rhythm parallels that of development, thus relating dental caries to deep-seated metabolic changes in the growing body.

5. The degree and prevalence of dental caries are unaffected by recurrent mouth and upper respiratory infections.

6. Dental caries is neither prevented nor minimized by breast feeding. Children free from dental caries were maintained in infancy on base-forming dietaries containing early additions of semi-solid feeding in the first months of life.

7. Children with moderate and extreme dental caries showed inadequate intake of vitamins B, C and D.

8. Children maintained on ketogenic diets that are base-forming in their mineral content showed low life caries indices, while those maintained on ketogenic diets acid-forming in their mineral content showed marked dental caries.

9. Children free from dental caries showed consistently a dietary intake ex-

cessive in alkali-forming minerals, with a preponderance of raw fruits and vegetables.

10. Races immune to dental caries consume sufficient raw alkali-forming fruits and berries to balance the acid-forming fresh fish and raw meat.

PROGNATHISM AND ITS SURGICAL CORRECTION BY A NEW PROCEDURE

By JOSEPH A. PETTIT, M.D., F.A.C.S., and C. H. WALRATH, D.M.D., Portland, Ore.

PROGNATHISM, or pronounced mesioclusion, is a pathologic entity and, if of marked degree, is amenable only to surgical correction. The operative treatment of this deformity, producing a conspicuous asymmetry of facial profile, has heretofore consisted (1) in the removal of a section from the body of the mandible, (2) a transverse bony cut through the ramus at the level of the posterior molar and a sliding back of that side of the mandible.

Skilled orthodontic treatment of the teeth, in a moderate degree of prognathism, may be adequate to correct visible asymmetry of facial profile. In any other than a moderate degree of prognathism, orthodontia will not suffice, because the alveolar process is displaced with the body of the bone. This condition is not due to displacement of individual teeth, or groups of teeth. The placement of the teeth, in reference to the alveolar process in which they are set and to each other, may be perfect in a well marked prognathism. The relative position, size and direction may harmonize exactly with the upper teeth. The displacement or structural asymmetry is due solely to the fact that the body of the mandible, with the contents of its alveolar ridge, lies in a forward position when the mouth is closed and cannot be moved backward far enough to produce the potential perfect occlusion.

The prognathous type of man presents a symmetrical protrusion of both maxillary bones. Prognathism is an asymmetrical protrusion of one or the other maxillary bone, or one side of one of them, producing a malocclusion of the teeth and a variable degree of deformity of facial profile.

The Neanderthal man, changing by evolution, according to Wells, into the Cro-Magnon, was the prognathous type, and his classification of the paleolithic, the first true man (*Homo sapiens*), represents the orthognathous, so-called Grecian profile. Prognathism is not racial nor hereditary, but a pathologic entity. It may be embryologic, an error in development, or due to a disparity in the symmetry of growth of obscure origin. Anatomically viewed, when occurring in connection with the mandible, it represents an obtuse angle of the mandible rather than an increased length of the body. Usually, concomitant overdevelopment of the mental process exists. Thus, a deformity of facial profile is apparent, and a distinct tooth malocclusion exists. This is prognathism, in contrast with the perfect occlusion of the sym-

metrical protruding upper and lower maxillary bones of the prognathous type of human being.

A simulating deformity may be produced by an old fracture with union in a distorted position or by an unreduced forward dislocation followed by a moderate degree of restoration of function. Roentgenographic investigation, physical examination and the history will determine the existence of such an unusual condition.

Fig. 1.—Patient before operation.

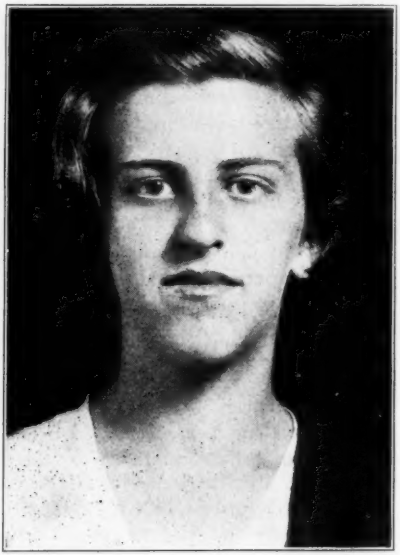

Fig. 2.—Patient after operation.

It was with the understanding of this basic principle that we devised a new surgical procedure for the correction of prognathism, discarding the standard resection operations heretofore employed. After we had performed this operation many times for ankylosis of the temporomandibular articulation, and with an understanding of the mechanics of the functional activities of this joint, it was possible to conceive the application of the principle of creating a backward bend in the condyloid process for the relief of prognathism.

It is well understood by students of this pathologic condition that prognathism does not represent an increased mandibular body length or size, but an obtuseness of the angle. A new flexible joint, constructed in the neck of the condyle, permits an angulation at that point, compensating for the obtuseness of the mandibular angle, at the same time that a backward bow is made possible.

Muscular attachments and function are not disturbed. Therefore, a "reduction," or return to normal occlusion, naturally ensues. Structures concerned with the mobility of the temporomandibular articulation (muscular and ligamentous) are such as to produce occlusion provided no mechanical impediment

prevents. When the underlying conditions of a prognathic case are removed, or anatomic impediments eliminated, the normal anatomic and physiologic activities of the mandibular structures will function normally.

These facts and statements seem perfectly proved in the case here presented. As far as a search of the literature goes, it is apparently the first time this surgical procedure has been employed for the relief of prognathism. The restoration of normal occlusion, of normal profile and of normal function has been perfect, and has been immediate. Its applicability to bilateral prognathism is the same as to unilateral. In bilateral ankylosis of the temporomandibular articulation, we secure the same good result as in unilateral ankylosis, with this operation. Bilateral prognathism is as amenable as unilateral prognathism to temporomandibular arthroplasty, and will give as excellent a result.

Fig. 3.—Patient before operation.

Fig. 4—Patient after operation.

Every old nonunion or fibrous union of a fracture permits a certain degree of motion at that point, owing to the interposition of fibrous tissue. Arthroplasty means the "making of a joint." This flexible fibrous tissue, being attached to the bone ends, prevents displacement or overriding and, at the same time, acts as a cushion, preventing friction and pain. The temporomandibular arthroplasty therefore consists in producing a carefully selected type of fracture, at a point to serve the desired purposes, followed by the interposition of an abundance of fibrous tissue in order to secure an "extra free" nonunion. Not being a result of chance or accident, the bony structures are correctly and carefully carved. The location is selected with proper consideration of muscle attachment and function. If these details are observed, the newly created joint can function by coordinated muscular action. The site selected is the neck of the condyloid process. The operation has heretofore been performed only for ankylosis and has been successful in restoring function to mandibles that have not opened mouths for years, owing to loss of joint motion.

In introducing this technic for the relief of prognathism, we did so with due consideration of the anatomic problems involved. In prognathism, the chin protrudes usually because of obtuseness of

the mandibular angle and not of an increased body length. On account of the contour of the condyloid head and the environment of the glenoid cavity, the mandible has only a forward and not a backward motion from the normal resting position. The production of a supplementary movable point just below the temporomandibular articulation permits a "backward bend." This point does not disturb the attachments of any muscles and therefore does not impair the muscle function. Normal apposition of the jaws is involuntary and ensues naturally when any existing impediment is removed. The new joint removes the backward impediment, and occlusion naturally ensues. The muscles bring the teeth into alinement, at first by voluntary effort, later by involuntary or unconscious action.

In order to insure the correct position, form and function of the new joint, or nonunion, as it might be called, of the fractured condyloid process, and in order that it may better achieve the results desired, the teeth are so wired as to maintain the correct position during the healing process. This fixed position establishes the shape and contour during the healing process and insures the functional activity of the new joint. This is especially important when the operation is performed for the correction of the deformity of prognathism in order to secure the abovementioned advantages. It is also important when the operation is performed for ankylosis in order that nonunion will occur correctly and give a proper pseudarthrosis. The details of this operation will be passed over except for mention of the fact that a small wedge between the posterior molar teeth is used to act as a fulcrum, holding the fractured ends apart during the process of healing and preventing pressure necrosis of the interposed fascia pad.

The muscles of mastication function undisturbed by the surgical procedure, probably with greater facility resulting from the removal of the mechanical impediment to normal occlusion of the teeth and mastication.

In the case presented, the patient now, after only a few months' time, experiences difficulty in demonstrating the original deformity. Only by a strained and forced effort and only inadequately can she reproduce the former deformity.

The superiority of the temporomandibular arthroplasty for the correction of prognathism as compared to other procedures heretofore employed may be briefly summarized as follows:

1. There is no destruction of nerve and blood supply, no tooth loss and no loss of body of bone. 2. No wire nor other foreign material is left in the tissues. 3. There is no danger of devitalization of teeth. 4. There is no visible scar, as this incision is within the hair line, showing only in front of the ear to a slight extent. 5. No loss of sensation occurs over the course of the mental nerve. 6. There is no danger of infection from a chance communication with the oral cavity. 7. Less bone trauma and destruction are present. 8. There is added mobility to mandibular function.

REPORT OF CASE

History.—S. M., a girl, aged 14, of negative family history, had, five years before, begun to note abnormal protrusion of the mandible, which became progressively worse until the condition shown in Figure 1 was produced.

The patient was a healthy girl, active in athletics and bright in school. She was gradually developing a sour, antagonistic attitude toward life and became sullen when engaged in conversation.

The mandible was abnormally prominent. The teeth were in good condition except for a slight narrowing in the biscupid and cuspid region in the maxillary arch and a slight mesioclusion on the left side with a decided mesioclusion of over 20 mm. on the right side.

As a result, the median line of the lower denture had shifted to the left. (Fig. 3.)

Roentgen-ray examination of the skull, jaws and teeth was otherwise negative. The tongue, which was well developed, was held against the lower left side. The general physical examination was negative.

There was no occlusion on the left side and poor occlusion on the right. Measurements of the models showed the following displacements: The anteroposterior space between the maxillary and mandibular central incisors was 2 mm. The median line had shifted to the left 8 mm. All teeth were present except the third molars.

Treatment.—Labial appliances and intermaxillary rubbers were placed, in March, 1930. The chin cap and head set were added in May, 1930. This procedure was continued until August, 1931, with only slight improvement on the left side as to mesioclusion and no improvement on the right side.

In August, 1931, the temporomandibular arthroplasty was performed on the right side, a wedge was temporarily placed between the molar teeth on this side and the jaws wired together in the anterior region with the median line of both arches in correct apposition during the healing process. (Fig. 4.)

Outcome.—The patient was able to maintain a normal occlusion and the deformity was fully obliterated after the operation. (Fig. 2.) Orthodontic treatment was continued to insure the success of the operation and afford a perfect balanced occlusion. The patient today has a fine disposition and all trace of her former mental attitude toward life is lost.

CONCLUSIONS

1. Maxillary prognathism is an orthodontic problem primarily.
2. There are extreme cases not amenable to orthodontic correction.
3. Most extreme cases of prognathism can be rendered amenable to correction by the construction of an additional joint in the condyloid process with or without supplementary orthodontic treatment.
4. This procedure is equally applicable to unilateral and bilateral cases.
5. Because of its advantages, this procedure would seem to supplant the former types of jaw resections.

A REVIEW OF THE YEAR

By NEWTON G. THOMAS, M.A., D.D.S., Chicago, Ill.

THERE is the ring of a sizable ambition in the title, "A Review of the Year," an ambition that had to be reduced as the intended undertaking progressed. The title was kept for the coverage it offered to what follows. The number of papers published, the number of subjects discussed, intimacies of the research carried on, money spent, enterprises carried out by the Association, facts of education, journalism, *et al.*, could not be assembled. And if they could have, the total appeared profitless from the beginning. Better to have an assemblage of outstanding facts than a collection of details. Better to catch the spirit of the game than to be too closely absorbed by individual plays. A review is in keeping with a year's end and such a review seemed eminently worth while.

Perhaps the most disturbing feature of such a review was that no one person could be equal to the task. His judgment must necessarily be worthless in many fields. As a result, many helpers must be sought, men who specialize here or there and who would know beyond a peradventure what had been done and is in the process of doing and what the program promises. There is, then, a composite of

opinions here, opinions earnestly solicited and graciously given. The ultimate receiver of this aid assumes the responsibility for the blend that is presented.

First of all, the American Dental Association itself comes to mind as the great propulsive force of dental health service. Its vast ramifications can have no part in this review, but a few suggestions might be sufficient to present its prestige and give it praise. Naturally, its most powerful thrust would be characteristic of the times that may affect it. During the past few years, "public service" and "the nation's health" have become more than the mere smacking of political lips; they have become phrases to conjure with. And it must not be forgotten that conjuring inevitably carries with it the disquieting wedlock of hope and fear. While many have wondered what of the morrow for dentistry, the Association has posted its observers where they can watch the portents of the first gleams of that day. Those words indicate a new consciousness of responsibility, a responsibility that is inevitable. Based on the premise that dentistry has a distinct place in public health organization, the American Dental Association sought and obtained alliance with the United States Public Health Service for effective and authoritative cooperation in establishing and operating a nation-wide dental health program. In other words, the American Dental Association is operating on the front line of national health need. It is there in the interest of the people it is intended to serve and of those who serve them.

A review of the year cannot overlook the development of a new emotion within the ranks of the profession. There is, without doubt, an awakening sympathy for those who have not come within the bounds of its ministrations, and obviously of themselves cannot. In times past, we have been quite content with our own well being, our own progress both individually and organizationally. But a new consciousness of responsibility seems to be stirring. Also, in times past, we have taken pride in far-flung protectorates of health that have been established and have pointed to them as proofs of an advancing civilization. One recalls the sound of medical and dental feet falling to the music of war, going up to the danger lines of battle with their anesthetics and surgery. It was the first time in history that anything like it had occurred. The shade of Florence Nightingale might have rejoiced at the sight. This new sentiment is a projection of that spirit. Dentistry is obviously looking for, thinking of and planning for an extension of its service, where it is needed. One judges by the voices that are raised in behalf of this vital, humanitarian service. And they increase in number.

Quite in custom, the new daunts many. Old words, old names are repeated and, at their mention, old fears, old ghosts arise. We are all so old in our inheritance that many have lost the zest for adventure. Where custom binds, the new is fearsome. But a dismembered civilization lies about us, its parts wriggling, headless. We live amid new conditions. Some thinking must come from somewhere, some daring to undertake, to assail, to apply. We are being called out of ourselves. Dare we go? It happens that dentistry is being regarded as a service of life. Oral disease in its insidiousness, its treachery to the vital organs, its gnawing at the cores of health, its undermining of strength, mind, purpose, ranks with the dangerous diseases and must be curbed. It must be curbed for the common good. A people cannot go on with destructive ills undermining it, and medicine, dentistry, the popular mind, be indifferent to their presence. Of this, dentistry is aware. In large centers,

experiments are being made. Lessons are being learned. There is an increasing cry for more. Dentistry must and will answer the cry. Said an A.D.A. official: "There is a finer spirit in dentistry today than ever before. Men have been forced back upon themselves, they have been made to think. There is a seriousness to their thinking, an honesty, an altruism that is new and full of promise."

During the past three years all of us have looked in awe upon the crumbling columns of our economic structure. Businesses that we thought were as monumental as the pyramids have gone to ruin. Whole nations have collapsed while their people have looked on in chattering dismay. Their languages failed them in their quest for ways and means. Their brains became blank when they sought methods of recovery. Note this! The American Dental Association has carried on. Not for a moment has it shown the blanching of fear. No committee, official group or governing body has been terrorized to the point where retrenchment was demanded. "We are carrying out virtually the program of our fat years," said an official. "Our extensions, researches, plans have not been diminished. Where money was not so plentiful as before a supplement of enthusiasm in the workers has maintained the organizations and output." Ululation and ballyhoo from a large organization such as this is unbecoming and unnecessary, but men on the farthest frontiers have every reason for pride in the fostering parenthood of their organization.

Two concentration centers of associational endeavor that reach to the farthest outposts of dental concern did not have their beginnings in the past year, but come within this review because of their effective continuity. Years ago, a conversation between practitioners was bound to include the question, "What amalgam do you use?" or "What investment?" and the sequent "How do you like it?" Cements too were a daily concern, and golds. The observation of an investment in a bowl or a cement under a spatula must be superficial at best and dictums on their serviceability were too often beyond the ken of the man most concerned. The argument and persuasion of a salesman gave sober men small comfort. The annoyance, the uncertainty of recurring disappointments, with no authority of higher appeal, was a source of profession-wide distress. Dentists should know what is good, better, best. They must know. A dependable means to that end was provided when conjunction was made with the Bureau of Standards. Today, a man can know the quality of the material that he uses.

Akin to the foregoing are such questions as "Why do you use that mouthwash, doctor?" Or "that powder or paste?" The practitioner was stumped for argument for or against a popularized lotion or other agent that his patient had fancied and wanted approved. No faith in anything on the part of a patient is a difficult mental state for a man to confront; faith in everything that is well ballyhooed is equally bad. And faith lays hold on most fictional aids; that we know. Nowhere more than here do people want to believe in something. Speaking from office experience, dentists know that this is a believing world. Facing it, what shall the dentist say? He dare not accept the label as the patient does; he must be analytical, didactic, intelligent, authoritative. But he could not be in the yesteryears. And among themselves dentists discussed tooth and gum medicaments, surgical pastes and the like. He was embarrassed, helpless; he needed protection. For his sake, the Bureau of Chemistry and the Council on Dental Therapeutics came into being. Men of scholarship and long experience in the

needed sciences were appointed to the job of protecting the practitioner where his need was most obvious, and today no man is so poor or so distant from the center of things that he cannot know the word to say with proof for saying it. An association-wide support of the Council returns an association-wide protection against office invasion by those who would sell only for gain.

Throughout the year, the subject of root canals and caries has held a prominent place. Of the former, it is said, "No outstanding development in their therapeutics has taken place." This does not mean that no work has been done. The relative efficiency of some materials used for the treatment of putrescent canals formed the basis of an investigation that was creditably carried out. The pulpless tooth suffered what is nearly a writ of doom in another series of experiments. Of the latter, some workers of long experience and integrity say, "The findings are indisputable, but the interpretations we do not accept." Easing the way out of that situation, still others say, "The only remedy for the pulpless tooth is extraction." It is obvious that until pulpless teeth are rendered impossible save by accident, careful workers will strive to keep them in use, free from infection and threat.

Dental disease, that is, the definitely dental and paradental, has received a vast amount of attention. Men singly and in groups have undertaken to unravel its intricacies, but at this moment the whole matter is in a state of flux. At this point, it is easier to quote. "There are those who contend that dental diseases are brought about through external means and are closely related to the problem of diet. On the other hand, there are a group of capable investigators who contend that diet controls the incidence of dental diseases. Both groups, no doubt, will ultimately be found to be both right and wrong. It is still too early in point of time to state in quantitative measure the influence of each. There can be no doubt that diet influences dental diseases in both its etiology and its incidence." The most significant feature of the work is in the concentrated attacks being made by groups scattered over wide areas led by men of approved ability and sincerity. Scholars no longer struggle insularly. One man, one lifetime may be much too futile, but the group and groups hold out the hope of solution.

Said a surgeon, "I know of nothing new or startling." A study of local anesthetics has been made, with the conclusion that "freshly prepared solutions, as contended by conservative authors for years, produce better results in general than the stock solution which usually requires acids and preservatives to maintain stability." He added, "Block anesthesia has led many men to attempt what they would not have attempted before. The time element is the reason. Following that came consciousness of a need to know more of the contributing factors to successful surgery and, as a consequence, a study of anatomy, pathology and biology. There is the secret of successful surgery—biology—to know what to expect of living tissues in health and disease. And more men are aware of this today than ever before. A demand for more thorough training to enable a better diagnosis and a wise or surgical interference is in the air."

Operative and prosthetic dentistry on the surface of things seems more nearly static. And yet the interest is in its first principles, the fundamentals, said one teacher. "Men have become disgusted with lackadaisical cavity preparation, 'sloppy' amalgams and synthetic filling materials, not to forget the abomination of a bad inlay." The gold foil as of old and with

modification is having a renaissance. The gold foil filling is a supreme test of technical ability of the dentist and it inspires a firm self-respect. He knows that he has given his patient a service that has little to mar its acceptability. It is a sort of last word in progress in this field, although it has been on the market for two generations and more. Ne plus ultra! This ideal needs the steadfastness that is being given it. We must not forget that for years American dentistry led the world in its technical accomplishment. Long before science became the shibboleth of either medicine or dentistry, operative dentistry had attained an enviable eminence. In these days when research is being applied to the living tissue phases of dental concern, operative dentistry has a critical fort to hold, and the evidence is that its watchmen are about and are trustworthy.

Also full denture specialists were slow to aver a specific item for acclaim. People are getting better dentures than ever before—finer tooth form—greater naturalness of color, better adaptation, more effective occlusion. A conscientious care is given to every detail of construction. A variance of opinion prevails on the question of molars and bicuspids. Cusps inverted or cusps everted is the question. Between them is the puzzle of ridge absorption. On this issue, there is a complete difference of opinion. Base materials are in process of perfection. Bearing names that may be faintly significant or utterly insignificant, they have appeared in numbers. Their primary purpose is to simulate tissue color and yet possess the virtue of vulcanite. "They will arrive," said an authority, "but they have not arrived yet."

Reference has been made to the value of collective investigations. A vital interest is to be found here. Accomplishment may be hoped for that was not possible when men labored alone, except, of course, for the rare inspiration that has, on widely separated occasions, startled the world by its revelations. One thinks of the various nests of research on vital issues scattered over the country with eager anticipation. There are the Purcell project in the College of Agriculture in the University of Arizona, the Bolton study of growth and development at Western Reserve University, the work of the Michigan and Columbia groups, to mention only a few. Some of them connote cooperation between dental schools and medical scholars or specialized students in given fields. Thus the whole domain of interest in physiology and pathology is brought into unified correlation, with infinitely more effective results. Then, too, there is the touch maintained between these working coteries to avoid duplication and waste. A fascinating idea comes to mind of a man whose needs are supplied by interested workers in physiology and biochemistry in a number of widely separated cities of the United States, in Canada, South America and China. The extent of the possible investigation is astounding to begin with and the economy is certainly impressive. The foregoing is given merely as an illustration. "What has been gained in the last two centuries has been due less to individual brilliance and inspiration than to the capacity which men have developed to work together in groups."

One lays a levy on education with reluctance. Its field is so great, its task so intricate and far reaching, its influence so nearly infinite. It assumes to equip a man for and direct him in his chosen field, to establish his ideals and make clear his relations, to send him out to serve in places high or low with efficiency and honor. One it inspires to a perfection of vision, of analysis, of deduction that constitutes

the foundation of what is called practice. Another it sends out with alert mind and skilled hands to make the connections between knowledge and need, to be a purveyor of science, transforming it into art. It was a triumph of self-consciousness when the American Association of Dental Schools appointed the Curriculum Survey Committee "to make a systematic study and analysis of the dental curriculum." The association designated that the modern requirements for dental health service be first ascertained; that there then be determined the knowledge and skill that should be possessed by the dentist; that a curriculum be recommended which will adequately prepare the undergraduate for dental practice; that the curriculum include training in the development of character, an appreciation of the humanities and a scientific outlook that will assure the graduate's interest in dental research.

This is a man's sized job, a job that it will take many men to do. And many men are doing it, doing it studiously, sympathetically, understandingly. They know they are dealing with the greatest of nature's variables, the human mind. They know that what they produce must have a biologic flexibility to it or it is doomed. They understand that there is an infinite range of possibilities presented at the registrar's desk and will not be dogmatic. They sense the fickleness of human choice and will try to adjudicate it. They know that what they present cannot be final; that finality is a mythical terminus when applied to human endeavor. But what they do will help, will advance the cause, will make a better dentistry. There is no doubt that their report will be one of the most interesting documents of a generation.

And the point of it all is that better men be forthcoming in the future than in the past. Dentistry has produced good men; they are in our midst. They have built what we now admire; they assaulted and took the strongholds we now occupy. And these same men it is who are saying "We must produce a better generation educationally and in character if possible than did the past." That is the magnanimity of parenthood.

This review ends with parts of the field untouched. Too many have contributed to it for it to contain bias. Its intent was to portray the year in broad lines, visible and understandable. Failures, short-comings, wrong-doings have not been reviewed even though they exist. The ultimatum of the year is to succeed in spite of them.

PRESCRIPTION WRITING: WHAT IT MEANS TO THE DENTIST

By GEORGE C. SCHICKS, Ph.G., Newark, N. J.

Writing a prescription has a professional significance. When a prescription is written, any desired drug, and in the strength desired, may be employed. When the maximum and minimum doses are known, the definite action that may be expected from the prescription is known. The use of an accepted proprietary dental preparation is not always satisfactory, as such a preparation comes always in the same concentration and combination. Writing one's own prescriptions makes it possible to adapt the medication to the individual patient.

Failure to write prescriptions has a very definite reaction, encouraging self-medication. Why? Because the patient will seldom return when the same or a similar condition arises. He will go to the drug store and buy another package of what he was told to get the last time he visited his dentist's office, or he will get a full size container of the sample given him.

The injustice to the patient becomes evident when he tries to clear up a self-diagnosed and frequently entirely different mouth condition with the proprietary preparation he was told to buy previously. Too often, in such situations, the pathologic condition gets beyond easy control before the patient returns to you or another dentist. A patient will hesitate to get a refill of a prescription months later, as the original prescription is filed with the pharmacist, when the same patient would not hesitate to go to a drug store and call by trade name for a packaged product.

The real injustice to the dentist arises when the patient attempts to alleviate one condition with a proprietary medication prescribed at a previous time and perhaps under different pathologic conditions. The patient may come to the conclusion that the dentist is incompetent and go elsewhere, or he may come to the dentist too late to be restored to his former condition.

I should like to preface the following remarks with the statement that I am not waging a campaign against the honest manufacturer of a nonsecret preparation with true claims as to its therapeutic action, but I find myself completely out of accord with the manufacturer of a secret remedy or a medication with false claims.

Advertising has become a tremendously powerful weapon to nostrum manufacturers. Seventy million dollars a year is spent by the makers and distributors of such medicines to promote their use by the public. Every conceivable method is used to popularize such products. If it were possible to determine what part of that seventy million dollars is used to package and distribute free samples to members of the medical and dental professions, the amount would undoubtedly be surprising. Some products advertised under this seventy million dollar expenditure

do merit the use by and the recommendation of the dental profession; but, from the maze of extravagant advertising, it is difficult to determine the true merits of a preparation.

You are acquainted with the ways in which you are encouraged to take part in this intricate advertising scheme. It has been said by men in your own profession that dentistry leads all other professions for exploitation by manufacturers of proprietary or patented products.

When the American Medical Association organized the Council on Pharmacy and Chemistry to investigate remedies peddled to men in its ranks, some of the quacks and fakers and makers of irrational remedies folded their tents and opened camp in your midst. Your leaders saw the light and took steps to rid your ranks of cure-all venders, and your Council on Dental Therapeutics was organized to protect men in your profession. It organized to determine the worth of various drugs and products used in dentistry, of tooth pastes, tooth powders, mouth washes and gum medicaments. It organized in order that dental practitioners might take the guesswork out of the use of medicaments and dentifrices. The Council is doing an excellent piece of work.

If you wish to help make its work effective, if you wish to see dentistry freed of some of the cureall campaigners, there is at least one way to do it. Say "No!" to the next detailer who tries to give you free samples for distribution of a product not approved by your Council.

Every wide-awake manufacturer of a product which has scientific usefulness will do everything he can to comply with the requests of the Council. If his product does not meet the requirements of the Council and he will not disclose its ingredients, beware! You should then know that there is at least one respect in which his product does not meet the requirements of the Council. That should be sufficient reason for you to refuse to make yourself an advertising medium for his product.

There may be a manufacturer of a useful product who is representing it truthfully and who may not have applied to the Council for approval. There may also be some who have originally fashioned their product to meet the regulations of the Council and who do not seek acceptance. Under such conditions, do not rely on the statements of the salesman. The Council is organized to provide scientific answers to such inquiries, and whether or not a proprietary product has been submitted by its maker for the approval of the Council, the latter will undoubtedly investigate such a product and send you a report. The demands it makes of manufacturers are fair and are aimed only to protect the interests of the dental profession. It asks only that a product have some scientific or therapeutic reason for its existence, that the material does what its maker claims for it, that its advertising is truthful and that it meets the other logical requirements of the Council as to composition, test and origin. There is nothing unreasonable in such requests.

It would seem then that any manufacturer who could not or would not meet those demands should not find an outlet for his product among men in the dental profession.

The distribution of free samples has an unprofessional aspect. It not only makes the dentist an advertising medium for the manufacturer, but each time the

former gives a patient a sample, he indirectly places his stamp of approval on that product. The matter does not rest there. The dentist not only approves the article, but also assumes responsibility for the effects of the preparation. These are very definite reasons that he should be thoroughly familiar with the merits of the product before he makes himself an advertiser of it. The day of the secret remedy is past. Every dental practitioner has a right to know—he *must* know—not only what medicaments he is prescribing, but also in what concentration and degree of purity they exist.

Prescription writing, then, should take on new significance. Here is a practically untouched field. Here lies a professional opportunity to intelligently adapt medicaments in the U.S.P. and N.F. to the individual needs of practice.

Choose the pharmacist in the community who has always looked first to the scientific aspects of his profession. It is such a man who is prepared to do more than merely fill a prescription. Permit him to work out special medicaments required for individual needs. He will render such assistance as will most effectively aid the dentist in his work, and will advise him in the economics of prescribing.

Pharmacy stands ready to serve professionally the members of the American Dental Association.

THE UNITED STATES PHARMACOPEIA: WHAT IT SHOULD MEAN TO THE DENTIST

By GEORGE C. SCHICKS, Ph.G., Newark, N. J.

At a time when travel was done by stage coach, and Indian arrows and tomahawks made even a short journey precarious, Dr. Lyman Spalding of New York headed a small group of physicians in the first attempt in this country to standardize drugs and preparations used in medicine. Until this time, uniformity in the use of therapeutic agents was seen only in the exchange of formulas and recipes among groups of physicians and apothecaries of the same locality. Different drugs and preparations were frequently designated by confusingly similar names, and not infrequently the same drug or preparation was markedly different in strength. It is obvious that such a lack of system in nomenclature and standardization wrought even more havoc when drugs were called for on prescription.

Through the influence of Dr. Spalding and his co-workers, the United States was divided, for the purpose of carrying on this work of standardization, into four districts, Northern, Southern, Middle and Western. Physicians in each district were asked to compile a list of drugs and therapeutic agents found by them to have therapeutic usefulness. The wisdom of such a standardization was readily apparent, but the perils of travel and the inadequate means of communication in those early days made it possible for only the Northern district, comprising the New England states, and the Middle district, made up of New York, New Jersey, Pennsylvania, Delaware, Maryland and the District of Columbia, to take part in the enterprise.

One hundred and sixteen years ago, a meeting of physicians representing each district was called in Washington, and the result of the work done by each group was presented. The contents of the district pharmacopeias were examined and, with some additions, consolidated into one work known as the United States Pharmacopeia, which was published in its first edition in 1820. Something of the earnestness of the makers of that first pharmacopeia can be appreciated when it is recalled that, in those days, the trip from New York to Washington was a matter of one week's travel under conditions which today would seem almost unbelievable.

Every ten years since 1820, the pharmacopeia has been revised until, at the present time, the eleventh edition is under preparation. The general committee of the U. S. P., composed of fifty-one members, is divided into fifteen subcommittees. The membership of the United States Pharmacopeial Convention is made up of officers of the convention, representatives from the Medical Departments of the Army and Navy, the United States Public Health Service, the United States Department of Agriculture and the Customs Service of the United States Treasury. Such national organizations as the American Medical Association, the American Dental Association, the American Pharmaceutical Association, the American Chemical Society, the National Wholesale Druggists Association and the National Boards of Pharmacy, as well as colleges of medicine, dentistry and pharmacy, are member organizations.

The fundamental purpose of the pharmacopeia is to list such drugs and preparations as have recognized therapeutic value. Such products are standardized as to composition, strength and purity. Each drug or preparation has an official title which has a uniform meaning to all persons using such a compilation. "Official" with reference to the U. S. P. drugs and preparations means that the compilation is official by virtue of its being compiled under the supervision and authority of the medical, dental and pharmaceutic professions, and is recognized by state and federal governments.

Drugs and preparations to be admitted to the U. S. Pharmacopeia are considered from two standpoints: (1) therapeutic usefulness and (2) pharmaceutic necessity. When the Food and Drug Act of 1906 was passed, the U. S. P. and N. F. were adopted as the standards for drugs, chemicals and preparations used in medicine. The National Formulary, a companion book to the United States Pharmacopeia, is published under the direction of the American Pharmaceutical Association and contains formulas which are commonly prescribed by physicians and dentists. The United States Pharmacopeia contains 624 drugs and preparations and the National Formulary 547 formulas and 214 simple drugs.

In addition to the fact that the U. S. P. sets the standard for drugs and preparations used in medicine, it contains only the well established and most used medicaments. Therefore, it should be looked on as a guide to determine the worth of products used in dentistry.

There are approximately 164 items listed in the U. S. P. and N. F. which the dental profession may find use for. These drugs and preparations may be classified as abrasives, analgesics, anesthetics, antacids, antiseptics, astringents, caustics, coloring agents, dental casting material, dental impression material, flavoring agents, germicides, hemostatics, hypnotics, liniments, mouth sprays and washes, narcotics, pulp capping varnishes, stimulants, toothache remedies and tooth powders.

Time was when dental care was sought only by those who by reason of education saw the need for it or by those who because of pain or facial protuberance were driven to the dentist's chair. Then dentistry was scarcely more than the science of extracting and filling teeth. Dental research has enlarged tremendously the scope of dental practice, until now pathologic, therapeutic and preventive dentistry have significance to even the layman.

Dental consciousness has developed so rapidly among all classes of people that the economic factor in dentistry is one which can no longer be ignored. Dental care from the standpoint of public health, should be made available to everyone needing it. Regardless of what method is employed to make dental care available, in the last analysis it is the individual patient who pays for the care, whether it be by way of taxation or of individual fee. If the cost of dental care under expert supervision is not within the ability of persons to pay for that service, they will either neglect their teeth and impair their health, resort to quack dental practitioners or attempt to diagnose and treat pathologic conditions by self-medication.

It would seem, then, that one way to keep the cost of dental care as low as possible would be to minimize the cost of medicaments and dental necessities in both office practice and in the drugs and preparations recommended to the patient for use. It is apparent that such a minimization could be made effective by the employment of such drugs and preparations as are not excessive in price.

The high priced prescription not only discourages patients from seeking dental care, but those patients become the dissatisfied customers of the pharmacist. Pricing of prescriptions varies of necessity. The factors governing the price asked for a prescription make price variation logical. The price of ingredients (which may vary with quality or the price asked by different manufacturers of the same or similar preparations), the cost of the container and the overhead are the determining factors. Perhaps the greatest price determining factor is the pronounced difference in price which exists between some proprietary forms of official drugs. When there is a marked difference in price between the proprietary form of a drug or preparation and its counterpart which is official in the U. S. P. or N. F. and identical as to composition and structure, why make the patient pay more than is necessary for such a product?

There are few exceptions to the rule that most patented or proprietary medicaments are a modification of drugs and preparations official in the U. S. P. and N. F. There is little need then for the many duplications under various patented and trademarked devices and brands which flood the market today. When an official U. S. P. or N. F. drug or preparation has the same active principle or is the same chemically or mechanically as its proprietary form, why not use the official product? Why not cut the cost of dental medicaments?

Make the United States Pharmacopeia a reference handbook when prescribing.

The Journal of the American Dental Association

212 East Superior St., Chicago, Ill.

C. N. JOHNSON, Editor

NEWTON G. THOMAS, Associate Editor

Published by the American Dental Association

All expressions of opinions and all statements of supposed facts are published on the authority of the writers over whose signature they appear, and are not to be regarded as expressing the views of the American Dental Association, unless such statements or opinions have been adopted by the Association.

Communications intended for publication in the scientific or literary pages of THE JOURNAL should be addressed to the Editor. All advertising or business matter should be sent to the Business Manager.

Subscription is included in the annual membership dues. The subscription rate to nonmembers is $3.50 a year in advance, this rate applying to both domestic and foreign subscribers. All foreign subscriptions are to be paid in United States money.

Editorials

AN OMINOUS PREDICTION

"At the Annual Meeting of the Philadelphia County Council of Home and School Association, May 9, 1933, Dr. Kenneth E. Appel, a psychiatrist of prominence, predicted that one million now normal school children will be mildly insane at some period of their lives. This mental illness will be the result of parental discord and one-sided development of the child's character."—*New England Journal of Medicine*, 209:158-159 (July 20) 1933.

If this prediction has any justification in fact, it is something for every man, woman and child to think about. A million children faced with the prospect of insanity—even "mild" insanity! In the United States of America! And this the result of "parental discord and one sided development of the child's character."

Are we to think lightly of these things? With all of our welfare work, and our philanthropic organizations, with all of our manifold efforts to elevate the status of society, and the genuine desire to raise our standards; with the devotion of noble men and women to the cause of a better humanity; for us to be told that at this stage of our civilization a million of our children are doomed to a future

clouded by almost certain mental aberration is a staggering statement to confront us.

At the very beginning of our reflection on this subject, we are almost tempted to question the prediction—it seems so impossible of realization, so wholly grotesque in its enormity, so depressing in its prospects. Statistics are at best very bewildering and in many cases lacking in reliability, and we would like to think that no such dire calamity faces us in the future. We end by complacently affirming that it simply cannot be, and we draw our mantle smugly around us and lie down to pleasant dreams.

But when we awaken to reality, we are startled to find how much there is of fact in the manifest trend of the times. We speak of parental discord as one of the agencies leading to mental affliction on the part of the children, and immediately we are told that there has been an increase of 600 per cent in divorces. What can we say of the heritage of the children when the vows of matrimony, holy or unholy, are flouted in this way? Divorce under certain conditions is justifiable and perfectly permissible, but the wholesale breaking of family bonds just through expediency or petty whim is demoralizing and pernicious. And if there are children in the family, the worst of the disaster always falls on them. The pathos of many little children left without the protecting care of both parents through divorce is one of the tragedies of the hour, and this has become so prevalent at times as to constitute itself almost a breakdown in our social order. We do not know, and there is no means of knowing, how intimate or direct the relation is between marital inharmony and the incidence of insanity, but it may safely be assumed that discord and divorce on the part of parents are at least not conducive to the mental balance of children, to say nothing of their moral or ethical welfare.

But the question is, what shall be done to rescue even a respectable percentage of the doomed million? We do not presume to be wise enough to say what our welfare groups are to do in the training of children to make them better men and women, and to contribute to their mental and physical balance, but of one thing we are certain, that in some respects the training is inadequate. Anything that tends to the cultivation of dependency among children is bad. Early

in life—earlier than most teachers think—the idea of individual responsibility should be instilled in every child. Whether in welfare groups or in the family circle, the child should be taught that he is the center of a separate entity, that there is something in him that there is not in any other human being, and that his moral responsibility is a part of himself as definitely as his hands, his feet, his brain or any other part of him; that if this mechanism of his goes wrong, it is usually his fault, particularly in matters of conduct or behavior.

Anything that encourages him to lay the burden on some one else is demoralizing. The first lesson of life that should be taught to every child is that he must assume the fundamental obligation of facing his own destiny without fear or favor. Let him know that he must take the consequences of every step, good or bad. One of the most unfortunate words in the English language is alibi, and we are not sure that it is even acceptable English. Facing the issue is good training for every child—for every individual, in fact. If there is one thing that strengthens character and leads to mutual stability, it is this. Too much coddling for man, woman or child is bad, and leads to lack of responsibility. Constant leaning on some one else saps resolve and weakens mentality. To be taught to stand foursquare to the world is one of the great lessons of life, and to be healthfully occupied with the pressing problems of daily life is to contribute to sanity of mind and vigor of body.

There is not the slightest need for a contemplated lack of mental balance in a million of our growing population if we bring up our children in a sane and sympathetic atmosphere, and set an example of righteousness and equity in all of our family and social relations. And this is a problem not only for our welfare workers, but also for our dentists, our physicians, our lawyers, our educators, and particularly for parents.

Will we accept the challenge implied in the remarks of the eminent psychiatrist and see what can be done about it, or will we merely drift along on the road to so-called easy street and let the future take care of itself in the way that the residents of easy street usually solve their problems? It is largely up to the citizens of today to say what shall happen to the children tomorrow.

THE ECONOMIC EQUITY OF A FEE FOR PROFESSIONAL ADVICE

In the November, 1933, number of *The Dental Journal of Australia,* there is an able editorial entitled "Professional Advice." It was inspired by a symposium on "Dental Economics," and is worthy of deep consideration by the members of the dental profession.

There can be no question as to the justice of a dentist's charging a fee for professional advice. Slipshod as are many of our customs in regulating our economic affairs, this custom of giving advice for nothing is one of the most prevalent and demoralizing. In recent cases in court in England and Australia, where dentists have sued to compel a fee for advice, the decisions have invariably gone in favor of the dentist, and justly so. To give advice regarding the conditions in the mouth of a patient implies that the dentist must have special knowledge that the layman does not possess. This knowledge was gained by a long course of training that cost time, effort and money, and there is no possible reason that the dentist should dispense this information without compensation. It is not done in the practice of medicine, law, engineering or any other of the professions. Why should it be done in dentistry?

In one of the cases in England, the court said: "You must not look on the professional man as a tradesman. He was imparting to you knowledge which it has taken him years to acquire."

It is encouraging to note that our legal authorities hold invariably that dentistry is a profession, and entitled to the status that enables its practitioners to receive compensation for dispensing advice to the public. The habit has become altogether too common for the people to go to a dentist and accept his services to the extent of his tendering expert advice on a given subject, and never think of offering to recompense him for his time and skill.

This is not the fault of the people. They have been trained by the dentist to expect this, and the people are not so conspicuously altruistic as to tender payment without some suggestion on the part of the profession that payment is expected. It is high time that our profession make a concerted effort to remedy this evil. Not till the equity of this matter shall have been brought home to our profession

and the people may we expect a reform, and not till this reform has been inaugurated shall we hope to achieve for ourselves the respect that is our due. As long as we conduct our affairs along the lines of barter and trade, just that long shall we be rated as tradesmen, but as soon as we demonstrate our real professional status by proceeding along professional lines, we shall soon be granted a professional status.

It may be argued with some justification that at this particular period in our economic maladjustment, the time is hardly propitious for the loosening of the purse strings of our patients, and that nothing should be done to add to the economic hardship of the public. What we most need is to do everything in our power to attract and hold patients, and to keep our practitioners busy, but the principle should constantly be advanced that, in equity to all, and particularly to the profession, we should no longer foster the idea that expert advice is a service which should be administered to the people without the compensating reward of financial recompense. As long as we permit present practices in this regard to prevail, the public will estimate us in accordance therewith, but as soon as we compel a just recognition of what is our due, we shall command commensurate respect.

ROOT CANALS AND THEIR THERAPY

The therapy of root canals implies an exposed pulp; an exposed pulp almost always implies a pulpless tooth, and a pulpless tooth implies—what? The question mark seems to be cut in crape.

Not many years ago—less than twenty—root canals were of small concern. For easier operating, pulps were removed; canals that had been open to the luck of the mouth were filled; half pretentious attempts at sterilization were made. Can the root be used? was the primary issue. If no painful response to the invasion of the canal took place, the root was used. The roentgen rays brought modifications to this procedure.

Let us refer to sterilization again. It had often been noted that partially filled roots had remained negative for years. Well-filled

canals had developed alarming apical changes. Result: Aseptic procedure is the important element; that, plus the patient's health at the time of the operation, perhaps. Men of good conscience strove for perfect technic and good results. Numerous technicians developed who showed completely filled roots with becoming pride. A smoothly solid mass of guttapercha ran faultlessly from pulp chamber to the root tip—in the films displayed.

Then came the focal infection didactic. Teeth were immediately suspect. Extracting began. Systemic disturbances of vague origin were attributed to teeth with root tip changes. Recoveries from various ills were heralded far and wide. The market appreciation of pulpless teeth went down. The next step was that all pulpless teeth were potentially dangerous. Physicians ordered them out, no matter how innocent or well-filled. Many dentists agreed with these decisions. Health was paramount. What is a tooth when health is at stake?

But some dentists disagreed. They were loath to consent to what seemed indiscriminate extractions. There were difficult restorations to be made. One tooth from a strategic point might mean a complete denture. With a difficult reconstruction, the dentist would have worry; a complete denture would be a source of distress to the patient. Both troubles are real enough in a dental office. Is the medical adviser sure the removal will mean relief? He is not; hence, the dentist is full of reluctance. Persistence of the malady and of the tooth meant faulty professional cooperation. Loss of the tooth and persistence of the malady meant bitter recrimination.

Another item that makes the dentist gray is the biologic factor. Suppose the patient is young, a woman, a person for whom the future is as yet unsettled, and the condemned tooth is an upper incisor? The dentist knows that his finest art cannot prevent disfigurement. What shall he do? Should he gamble with the slowly injurious perfectly filled root and the resistance of youth?

We are now in the bacteriologic era. Innocent looking teeth have been subjected to the acid test and found far from innocent. Bacteria cluster about the apices of sound, live teeth, probably owing to contamination. But the apically sound, roentgenographically good pulpless tooth has 750 times more. In other words, such a tooth

keeps open house to militant germs. Resection has been suggested for feasible roots that show distress. But—still thinking of the innocent-appearing pulpless tooth—a resected tooth is still pulpless and welcomes its guests with the same cordiality as before.

Still another item, but slightly considered in this connection, is root-canal form. In 1917, Hess filled canals of teeth with molten Wood's metal under pressure. Then he removed the tooth from the cores and photographed them—986 of them. A translation of his findings and the photographs appeared in THE JOURNAL in September and October, 1921. In 1925, he published the work again in book form in copartnership with Zurcher. In August of this year, he presented the same pictures to the Congress. The canals bifurcate, twist, skein, loop in the weirdest fashion. They show every conceivable irregularity. Marrow canals (from internal absorptive processes) run to the surface in any part of the root. Multiple termini penetrate the apex. To see them is to wonder how one could hope to sterilize them. Cleaning them is an impossibility. Filling them is out of the question. Interestingly too, no roentgenograms show more than two or three of these termini filled even when the most painstaking artist does the work. This, despite the fact that teeth show from one to fifty terminal foramina, as doubtless all histologists of experience know.

Thoughtful surgeons and painstaking scientists have scanned the subject with sharp care. They consent to the treatment of teeth in carefully selected phrases, while over their permission hangs an unmistakable shadow of uncertainty. Their concession is made to operative or prosthetic dentistry—a necessity that every practitioner confronts—and an honest confession of dubiety and hope. Then a quotation like this appears: "By no means does the certainty of the known methods of root-canal treatment compare with the certainty of extraction." (Stein.) Or this: "Much uneasiness would be relieved if it were possible to tell with confidence—whether a pulpless tooth was actually or potentially a source of danger—or might be retained with negligible hazard to the patient." (Appleton.) Or this: "While the problem of periapical infection as a problem of pure biology is not without its attractions, I am not sure that from a dental or humanitarian standpoint it is worth the time

or money that will have to be spent for its solution. The only practical solution to the problem of the pulpless tooth, I fear, is not to have pulpless teeth." (Appleton.) And finally: "Focal infection is no longer a theory but a principle of dental and medical practice. The solution of the pulpless tooth question is that of prevention. In other words, prevent the pulpless tooth." (Hatton.) Evidently pulpless teeth belong to the "continuate and inexorable maladies," for the time to be.

Osler once spoke of "maladies against which we can scarcely ever hope to have curative measures." In that phrase, he unwittingly classed our problem as it stands. Some of the maladies that he had in mind, dread and grisly as they were, have been conquered. Science and art must still continue their attack on the pulpless tooth until some finger presses the key that vanquishes caries. Caries banished, the pulpless tooth will cease to torment us.

T.

A NEW COLUMN

Some one has said, "Proverbs are the coin of experience." THE JOURNAL wants your coin. It may be of your own minting; if it is, do not demonetize it with too much modesty. Send it to us. You might have found it in your general reading; it might have developed out of a tense moment of practice. If it is apropos of dental interest, that is the stamp of its worth to this column. As you will see, this gives you a wide range. A "proverb" of practice is also acceptable; the thing you have found expeditious, sound in principle, effective in service that you would like to pass on. Compact paragraphs and well-aimed epigrams will be stolen from papers that come to the desk and regarded as "grist for this mill." Let no one be surprised to see his words repeated. Such words, as we intimate, do not appear where thinking is loose, information is inadequate and sentences are articulated by accident. Hence, we intend that every quotation is a compliment of agreement and appreciation. Brevity consistent with clarity is half of any motto; the other half is the appropriateness of the message. No poetry will be used and no jokes. This does not exclude alert wit or offenseless humor. If what

you send is not thought suitable, do not be offended or discouraged; try again.

Your JOURNAL, your Column, your contribution.

T.

SYSTEMATIZE YOUR WORK

Much of the misadventure in life is due to lack of system, and this is particularly true of a practical pursuit like dentistry. In many of our offices, there is much waste motion through lack of system. And this lack of system is often translated into a grievous loss that marks the difference between a profitable and an unprofitable practice. Lack of system in technical procedures such as those involved in the practice of dentistry is expensive in time, and time is money. Many operators are wasteful in this regard, not only of their own time but also of their patient's time, and patients are becoming more alert as to time wasted by professional men. It is tiresome to an observant patient to see an operator forever fumbling about his instruments and appliances, and this often leads to loss of confidence in the operator's ability. A quick, precise and exact way of doing things inspires confidence and tends to peace of mind. Most of the lack of system is due to mental laziness, and mental laziness has no place in professional life. System lubricates the machinery of life and makes it run more smoothly and more efficiently. Not only that, but the machine will last longer.

BACK JOURNALS AND REINSTATED MEMBERS

Upon resumption of membership in the Association, the reinstated member often asks for THE JOURNALS that he has missed during the interim. Obviously the possibility of supplying the copies depends upon the number available and other contingencies. It is the policy of the Association to supply all missed JOURNALS as nearly as possible.

COUNCIL ON DENTAL THERAPEUTICS

ACCEPTED DENTAL REMEDIES

The following articles have been accepted as conforming to the rules of the Council on Dental Therapeutics of the American Dental Association for inclusion in the list of Accepted Dental Remedies. The Council desires dentists to understand that the admission of an article does not imply a recommendation. A copy of the rules which govern the Council in the consideration of articles will be sent on request.

SAMUEL M. GORDON, *Secretary*

CALCIUM COMPOUNDS[1]

DICALCIUM PHOSPHATE-VICTOR.—Secondary calcium phosphate, calcium hydrophosphate. $CaHPO_4.2H_2O$. Dicalcium phosphate-Victor contains approximately 97.0 per cent $CaHPO_4.2H_2O$. A salt prepared by the controlled interaction of phosphoric acid and milk of lime.

Actions and Uses: Dicalcium phosphate-Victor is proposed for incorporation in dentifrices of paste and powder form. Its use for this purpose is held to be advantageous because of the fineness of the particles and relative freedom from abrasiveness and scratching. It is marketed with close attention to physical and chemical characteristics. Its glycerine absorptive capacity is relatively low. Typical tooth paste formulas made with dicalcium phosphate-Victor contain relatively large amounts of the "polishing agent." It lends itself particularly to incorporation in soap-free dentifrices.

Manufactured by the Victor Chemical Works, Chicago, Ill. No U. S. patent or trademark issued.

Physical Properties: Specific gravity, 2.39; pounds per cubic foot, 38.3.

The specific gravity is determined by displacement of xylene in a pyknometer of the Hubbard type.

Particle Size: The particle size determined essentially after the method of Perrot and Kinney (*J. Am. Ceramic Soc.*, 6:417, 1923. See also Chamot and Mason: Handbook of Chemical Microscopy, 1:408-420, 1930, for a discussion of fineness of ground materials) should show only a trace of particles of the order approximating 20 microns[2] in longest diameter. A typical distribution of particles in dicalcium phosphate-Victor for incorporation in dentifrices is as follows:

Particle size:	$<1\ \mu$ (0.001 mm.)	1-5 μ	5-10 μ	$>$ 10 μ
	75.6%	18.9%	4.8%	0.70%

Abrasiveness and Scratching: The abrasiveness of dicalcium phosphate-Victor as determined against a highly polished silver surface (2.7 Moh's scale, 96 Bierbaum units) [Hodge and McKay: Microhardness of Teeth, *J. A. D. A.*, 20:227 (Feb.) 1933] made to rotate against a paste of dicalcium phosphate-Victor with glycerite of starch in such manner that the only variable is the abrasiveness of the material being examined and under a weight of 100 gm. at 2,000 revolutions on a test machine (details filed with the Council), no loss in weight (0.0000 gm.) should be noted. The silver test piece should not be visibly scratched when viewed under a metallographic microscope and photographed after 100 revolutions under a weight of 150 gm.

Dicalcium phosphate-Victor occurs as a white, odorless and tasteless powder. It is almost insoluble in water, but is readily soluble in diluted mineral acids. Water agitated with dicalcium phosphate is neutral to litmus paper.

Dissolve 0.2 gm. of dicalcium phosphate in 5 c.c. of diluted hydrochloric acid, add drop by drop ammonia water until a precipitate forms, add 1 c.c. of acetic acid, followed by 1 or 2 c.c. of

1. Calcium Compounds, J. A. D. A., 20:2072 (Nov.) 1933.

2. 1 micron (1 μ) = 0.001 mm. = 1/25000 inch (0.00004 inch). The diagonal opening of a 400 mesh wire sieve is approximately 34 microns.

ammonium oxalate solution: a white precipitate forms. Dissolve 0.2 gm. of dicalcium phosphate in a slight excess of diluted nitric acid and add ammonium molybdate solution: a yellow precipitate forms which is soluble in ammonia water.

Mix 0.2 gm. of dicalcium phosphate-Victor with about 5 c.c. of water, then add 20 c.c. of a neutral solution of silver nitrate (1:20) and agitate the mixture for about two minutes, keeping protected from light, and filter. The liquid is acid to litmus (distinction from tricalcium phosphate) and the precipitate is a pure yellow, free from brown or gray (uncombined calcium oxide).

A solution of 0.2 gm. of the salt in 10 c.c. of water and just sufficient hydrochloric acid is not darkened by the addition of an equal volume of hydrogen sulphide water *(heavy metals)*. Mix 0.5 gm. of the salt with 3 c.c. of water and immediately add 3 c.c. of diluted hydrochloric acid. Not more than a few gas bubbles should be evolved *(carbonate)*. Dissolve 0.2 gm. of dicalcium phosphate in 10 c.c. of diluted nitric acid and add 1 c.c. of silver nitrate solution. Not more than a slight turbidity results *(chloride)*. To a solution of 0.5 gm. of the salt in 10 c.c. of diluted hydrochloric acid, filtered if necessary, add a few drops of diluted sulphuric acid. No turbidity is produced in ten minutes *(barium)*.

Dissolve 0.2 gm. of dicalcium phosphate in 5 c.c. of diluted nitric acid, add a few cubic centimeters of sulphuric acid and heat until fumes of sulphur trioxide are evolved. Add 10 c.c. of sulphurous acid solution, evaporate until the solution is free from sulphur dioxide, dilute the evaporated solution to 5 c.c. This meets the U.S.P. X limit for arsenic. Digest 2 gm. of the salt with 100 c.c. of water for one-half hour on a steam bath, cool, add sufficient water to restore the original volume, stir well, filter, evaporate 50 c.c. of the filtrate to dryness in a porcelain dish, and ignite the residue gently. The weight of the residue does not exceed 0.015 gm. *(soluble salts)*. Dissolve 0.2 gm. of dicalcium phosphate in the smallest possible amount of diluted hydrochloric acid, filter, wash, make the filtrate up to 49 c.c. and add 1 c.c. of barium chloride solution. The turbidity produced should not be greater than is apparent in a similarly made up control tube using 2 c.c. fiftieth-normal sulphuric acid in place of the dicalcium phosphate (see U.S.P. X, p. 462). Agitate 1 gm. of dicalcium phosphate with 30 c.c. water for five minutes, filter and add to the filtrate 2 drops of phenolphthalein solution. The pinkness, if any, is completely discharged by one drop of tenth-normal acid *(uncombined calcium oxide)*.

Weigh a 2.5 gm. sample and transfer to a 250 milliliter beaker. Dissolve in 100 milliliters of distilled water and 15 milliliters of concentrated nitric acid. Boil for fifteen minutes, cool, transfer to a 250 milliliter flask, and make up to mark with distilled water. Transfer a 10 milliliter aliquot to a 250 or 400 milliliter beaker, add 50 milliliters of distilled water, 17 milliliters of ammonium hydroxide, 21 milliliters of concentrated nitric acid and an excess (50 milliliters) of ammonium molybdate solution, prepared according to section 5 (a), page 14, "Methods of Analysis," A. O. A. C. (1930). Stir vigorously and let stand in a warm place, at about 45 C., for 30 minutes. Filter with vacuum through a Hirsch funnel, using a pad of paper pulp. Wash acid free with cold distilled water. Transfer the precipitate and pad to the original beaker. Dilute to about 150 milliliter volume with distilled water. Dissolve the precipitate in 0.3238 N sodium hydroxide using 3 to 5 milliliters in excess. Stir until all of the yellow precipitate is dissolved. Add about 1 milliliter of phenolphthalein solution (0.25 per cent in 50 per cent alcohol) and backtitrate with 0.1619 N nitric acid. Another milliliter of phenolphthalein solution is added and any pinkness which may develop is again titrated out with the standard nitric acid. Further 1 milliliter portions of indicator are added, followed by standard acid until no further pinkness develops on addition of more indicator. One milliliter of 0.3238 N NaOH consumed—1.0 per cent P_2O_5 on a 10 milliliter aliquot. The amount of phosphate should be not less than 40.5 per cent nor more than 42.0 per cent as P_2O_5.

Weigh a 0.5 gm. sample and transfer to a 250 milliliter beaker. Add 100 milliliters of distilled water, 20 milliliters concentrated hydrochloric acid and 10 milliliters nitric acid. Boil down to a small volume (about 5 milliliters) to expel oxides of nitrogen. Take up in 25 milliliters of dilute hydrochloric acid (1 part concentrated HCl to 3 parts H_2O). Heat until dissolved. Make slightly alkaline to methyl orange indicator with ammonium hydroxide. Bring back with the dilute HCl to slightly acid. The precipitate must all be in solution. Add 25 milliliters of ammonium acetate solution (dissolve 450 gm. of chemically pure ammonium acetate in 1,800 milliliters of distilled water; add 100 milliliters of glacial acetic acid and filter before using) and allow to stand on a hot plate until the precipitate coagulates. (The temperature of

the solution should be between 70 and 75 C.). Filter while hot through OB filter paper. Wash once with hot (70 C.) distilled water. Dissolve the precipitate off the paper, in the funnel, with hot dilute hydrochloric acid, and wash the filter paper acid free, catching the solution and washings in a 250 milliliter beaker. Add 10 milliliters of a 10 per cent sodium ammonium phosphate solution and reprecipitate as above. Filter and wash acid free (litmus paper indicator) with hot distilled water (70-75 C.). The filtrate is combined with the filtrate from the first precipitation of the iron and alumina and heated almost to boiling and 25 milliliters of a saturated solution of ammonium oxalate is slowly added. Let stand at 70-100 C. until the calcium oxalate settles out. Filter, wash the beaker out thoroughly to remove all ammonium oxalate, passing the washings through the filter paper, and then wash the paper acid free with hot distilled water. Remove the filter paper containing the precipitate from the funnel, and return it to the original beaker. Cover the filter paper with 100 milliliters of distilled water; add 25 milliliters of approximately 25 per cent sulphuric acid, heat to 70 C., and titrate to a faint permanent pink with N/10 potassium permanganate. One milliliter N/10 $KMnO_4$=0.0028 gm. CaO. The amount of CaO should not be less than 32.5 per cent nor more than 33.5 per cent.

On ignition at 800 C. for eight hours, dicalcium phosphate-Victor loses not less than 24.0 per cent nor more than 27.0 per cent.

Weigh 3 gm. accurately into a moisture pan and dry in an electric oven at 85 C. for five hours. The loss should not be more than 2.2 per cent.

TRICALCIUM PHOSPHATE-VICTOR.—Tertiary calcium phosphate $Ca_3P_2O_8$. Tricalcium phosphate-Victor contains approximately 86.3 per cent of $Ca_3P_2O_8$ as $Ca_3P_2O_8.H_2O$, 12.3 per cent, and $3(Ca_3P_2O_8).Ca(OH)_2$, 80.6 per cent. A mixture of tricalcium phosphate and basic tricalcium phosphate prepared by the controlled interaction of phosphoric acid and milk of lime.

Actions and Uses: Tricalcium phosphate-Victor is proposed for incorporation in dentifrices of paste and powder form. Its use for this purpose is held to be advantageous because of the fineness of the particles and relative freedom from abrasiveness and scratching. It is sold with close attention to physical and chemical characteristics. Its glycerine absorptive capacity is relatively high. Typical tooth paste formulas made with tricalcium phosphate-Victor contain smaller amounts of the "polishing" agent than is present in dicalcium phosphate dentifrices. It lends itself to incorporation in soap or soap-free dentifrices.

Manufactured by the Victor Chemical Works, Chicago, Ill. No U. S. patent or trademark issued.

Physical Properties: Specific gravity, 2.68; pounds per cubic foot, 34.7.

The specific gravity is determined by displacement of xylene in a pyknometer of the Hubbard type.

Particle Size: Determination of the particle size essentially after the method of Perrot and Kinney (*J. Am. Ceramic Soc.*, 6:417, 1923. See also Chamot and Mason: Handbook of Chemical Microscopy, 1:408-420, 1930, for a discussion of fineness of ground materials) should show only a trace of particles in the order approximating 20 microns[2] in longest diameter. A typical distribution of particles in tricalcium phosphate-Victor for incorporation in dentifrices is stated to be as follows:

Particle size:	$<1\ \mu$ (0.001 mm.)	1-5 μ	5-10 μ	$>$ 10 μ
	64.8%	28.0%	1.5%	5.6%

Abrasiveness and Scratching: The abrasiveness of tricalcium phosphate-Victor as determined against a highly polished silver surface (2.7 Moh's scale, 96 Bierbaum units) [Hodge and McKay: Microhardness of Teeth, *J. A. D. A.*, 20:227 (Feb.) 1933] made to rotate against a paste of tricalcium phosphate-Victor with glycerite of starch in such manner that the only variable is the abrasiveness of the material being examined, and under a weight of 100 gm. at 2,000 revolutions on a test machine (details filed with the Council), no loss in weight (0.0000 gm.) should be noted. The silver test piece should not be visibly scratched when viewed under a metallographic microscope and photographed after 100 revolutions under a weight of 150 gm.

Tribasic calcium phosphate occurs as a white, odorless and tasteless powder. It is almost insoluble in water but is readily soluble in diluted mineral acids. Water agitated with tribasic calcium phosphate is neutral or acquires a slight alkaline reaction to litmus paper.

Dissolve 0.2 gm. of tribasic calcium phosphate in 5 c.c. of diluted hydrochloric acid, add drop by drop ammonia water until a precipitate forms. Add 1 c.c. of acetic acid followed by 1 or 2 c.c. of ammonium oxalate solution. A white precipitate forms. Dissolve 0.2 gm. of tribasic calcium phosphate in a slight excess of diluted nitric acid and add ammonium molybdate solution. A yellow precipitate forms which is soluble in ammonia water. Mix 0.2 gm. of tribasic cal-

cium phosphate with about 5 c.c. of water, then add 20 c.c. of neutral solution of silver nitrate (1:20) and agitate the mixture for about two minues, keeping protected from light. The liquid is neutral to litmus paper *(distinction from dibasic phosphate)*, and the precipitate is of a pure yellow, free from brown or gray *(uncombined calcium oxide)*. A solution of 0.2 gm. of the salt in 10 c.c. of water and just sufficient hydrochloric acid is not darkened by the addition of an equal volume of hydrogen sulphide water *(heavy metals)*. Mix 0.5 gm. of the salt with 3 c.c. of water and immediately add 3 c.c of diluted hydrochloric acid. Not more than a few gas bubbles should be evolved *(carbonate)*. Dissolve 0.2 gm. of tribasic calcium phosphate in 10 c.c. of diluted nitric acid and add 1 c.c. of silver nitrate solution. Not more than a slight turbidity results *(chloride)*. To a solution of 0.5 gm. of the salt in 10 c.c. of diluted hydrochloric acid, filtered if necessary, add a few drops of diluted sulphuric acid: no turbidity is produced in ten minutes *(barium)*. Dissolve 0.2 gm. of tribasic calcium phosphate in 5 c.c. of diluted nitric acid, add a few cubic centimeters of sulphuric acid and heat until fumes of sulphur trioxide are evolved. Add 10 c.c. of sulphurous acid solution, evaporate until the solution is free from sulphur dioxide, dilute the evaporated solution to 5 c.c. This meets the U.S.P. X limit for arsenic. Digest 2 gm. of the salt with 100 c.c. of water for one-half hour on a steam bath, cool, add sufficient water to restore the original volume, stir well, filter, evaporate 50 c.c. of the filtrate to dryness in a porcelain dish, and ignite the residue gently. The weight of the residue does not exceed 0.020 gm. *(soluble salts)*. Dissolve 0.2 gm. of tribasic calcium phosphate in the smallest possible amount of diluted hydrochloric acid, filter, wash, make the filtrate up to 49 c.c. and add 1 c.c. of barium chloride solution. The turbidity produced should not be greater than is apparent in a similarly made up control tube using 2 c.c. fiftieth-normal sulphuric acid in place of the tribasic calcium phosphate (see U.S.P. X, page 462). Agitate 1 gm. of tribasic calcium phosphate with 30 c.c. water for five minutes, filter and add to the filtrate 2 drops phenolphthalein solution. The pinkness, if any, is completely discharged by one drop of tenth-normal acid *(uncombined calcium oxide)*.

Weigh a 2.5 gm. sample and transfer to a 250 milliliter beaker. Dissolve in 100 milliliters distilled water and 15 milliliters concentrated nitric acid. Boil for fifteen minutes, cool, transfer to a 250 milliliter flask and make up to mark with distilled water. Transfer to 10 milliliter aliquot to a 250 or 400 milliliter beaker, add 50 milliliters of distilled water, 17 milliliters of ammonium hydroxide, 21 milliliters of concentrated nitric acid and an excess (50 milliliters) of ammonium molybdate solution prepared according to section 5 (a), page 14, "Methods of Analysis," A. O. A. C. (1930). Stir vigorously and let stand in a warm place, at about 40 C., for 30 minutes. Filter by suction through a Hirsch funnel, using a pad of paper pulp. Wash acid free with cold distilled water. Transfer the precipitate and pad to the original beaker. Dilute to about 150 milliliters with distilled water. Dissolve the precipitate in 0.3238 N sodium hydroxide using 3 to 5 milliliters in excess. Stir until all of yellow precipitate is dissolved. Add about 1 milliliter of phenolphthalein solution (0.25 per cent in 50 per cent alcohol), titrate excess sodium hydroxide with 0.1619 N nitric acid. Another milliliter of phenolphthalein solution is added and any pinkness which may develop is again titrated out with the standard nitric acid. Further 1 milliliter portions of indicator are added, followed by standard acid until no further pinkness develops on addition of more indicator. One milliliter of 0.3238 N NaOH consumed=1.0 per cent P_2O_5 on a 10 milliliter aliquot. The amount of phosphate should be not less than 39.3 per cent nor more than 40.1 per cent, as P_2O_5.

Weigh a 0.5 gm. sample and transfer to a 250 milliliter beaker. Add 100 milliliters distilled water, 20 milliliters concentrated hydrochloric acid and 10 milliliters concentrated nitric acid. Boil down to a small volume (about 5 milliliters). Take up in 25 milliliters of dilute hydrochloric acid (1 part concentrated HCl to 3 parts H_2O). Heat until dissolved. Make slightly alkaline to methyl orange indicator with ammonium hydroxide. Add dilute HCl to slightly acid until the precipitate is in solution. Add 25 milliliters of ammonium acetate solution (dissolve 450 gm. of chemically pure ammonium acetate in 1,800 milliliters of distilled water; add 100 milliliters of glacial acetic acid.) and allow to stand on a hot plate until the precipitate coagulates. (The temperature of the solution should be between 70 and 75 C.) Filter while hot. Wash once with hot (70 C.) distilled water. Dissolve the precipitate off the paper, in the funnel, with hot dilute hydrochloric acid, and wash the filter paper acid free, catching the filtrate and washings in a 250 milliliter beaker. Add 10 milliliters of a 10 per cent sodium ammonium phosphate solution and reprecipitate as above. Filter, and wash acid free (litmus paper in-

dicator) with hot distilled water (70-75 C.). The combined filtrates are heated almost to boiling and 25 milliliters of a saturated solution of ammonium oxalate is slowly added. Let stand at 70-100 C. until the calcium oxalate settles out. Filter, wash the beaker out thoroughly to remove all ammonium oxalate, passing the washings through the filter paper, and then wash the paper acid free with hot distilled water. Remove the filter paper containing the precipitate from the funnel, and return it to the original beaker. Cover the filter paper with 100 milliliters of distilled water, add 25 milliliters of approximately 25 per cent sulphuric acid, heat to 70 C. and titrate to a faint permanent pink with N/10 potassium permanganate. One milliliter N/10 $KMnO_4$=0.0028 gm. CaO. The amount of CaO should not be less than 51.1 per cent nor more than 52.3 per cent.

On ignition, at 800 C., for eight hours, tricalcium phosphate-Victor loses not less than 4.6 per cent nor more than 5.7 per cent.

Weigh accurately 3 gm. into a moisture pan, and dry in an electric oven at 95-98 C. for five hours. The loss should not be more than 2.25 per cent.

ANESTHETICS-LOCAL[3]

PROCAINE BORATE.—1-amino-benzoyl-2-diethylamino ethanol-penta-*m*-borate: *β*-diethylaminoethyl-*p*-amino-benzoate penta-*m*-borate. $C_6H_4.NH_2COO.C_2H_4.N(C_2H_5)_2.5HBO_2$—A borate formed by the interaction of *p*-aminobenzoyl-diethylaminoethanol (procaine base) and boric acid in the same organic solvent. Procaine borate contains 51.8 per cent of *p*-aminobenzoyl-diethylaminoethanol.

Actions and Uses: Procaine borate closely resembles procaine hydrochloride in its actions and uses. The molecule is heavier than that of procaine hydrochloride, but the toxicity and the anesthetic activity are closely proportional to the procaine base which they contain. When injected subcutaneously, procaine borate exerts a prompt and powerful anesthetic action. It is nonirritant. The testimony concerning its activity when applied to mucous membranes lacks uniformity.

Dosage: For infiltration anesthesia, solutions of 0.5 to 1 per cent; for blocking nerves, from 1 to 2 per cent; mucous surfaces, 2 to 20 per cent, depending on the location and the depth of anesthesia required. Its action is enhanced by the addition of a small amount of epinephrine, as in the case of procaine hydrochloride. Owing to the smaller content of the base in procaine borate, the total dose may exceed that of procaine hydrochloride by about 50 per cent.

Procaine borate occurs as a fine, white, odorless, crystalline powder. When applied to the tongue, it possesses a slightly bitter taste, followed by a sense of numbness. It is permanent in air; freely soluble in water, about 1:4; soluble in alcohol, insoluble in acetone, benzene, chloroform and ether. Its aqueous solution (1:10) is alkaline to litmus dissociating hydrolytically. Procaine borate "melts" at 163-166 C.

Other tests of identity and purity appear in New and Nonofficial Remedies, 1933, page 56.

Procaine Borate-Searle: A brand of procaine borate.

Manufactured by G. D. Searle & Co., Chicago, Ill. No U. S. patent or trademark.

Procaine Borate and Epinephrine Tablets-Searle: Each tablet contains procaine borate 0.05 gm. and epinephrine 0.0001 gm. One tablet dissolved in 2.5 c.c. of water yields a 2 per cent solution of procaine borate with a p_H of approximately 8, and epinephrine 1:25000.

BISMUTH COMPOUNDS[4]

BISMUTH SODIUM TARTRATE-SEARLE.—A basic sodium bismuth tartrate containing from 72.7 to 73.9 per cent of bismuth.

Actions and Uses: Bismuth sodium tartrate-Searle was originally proposed as a means of obtaining the systemic effects of bismuth in the treatment of syphilis. It appears to be used to some extent locally in the treatment of Vincent's infection by topical application, until the active infection has subsided.[5] It is advisable to supplement this use by local mechanical treatment of the teeth and gums.

---

3. Anesthetics—Local, J. A. D. A., 20: 1895 (Oct.) 1933.

4. Bismuth Compounds, J. A. D. A., 20:1906 (Oct.) 1933.

5. Rosenthal, S. L.: Vincent's Infection Acute, Subscute and Chronic, J. A. D. A., 20:438 (March) 1933. Rose, E. D.: Effects of Periodontal Lesion, J. A. D. A., 20:840-853 (May) 1933. Harrell, Vos: Present Status of Plaut-Vincent's Infection, Arch. Otolaryngol., 14:1-8 (July) 1931.

Dosage: By topical application.

Manufactured by G. D. Searle & Co., Chicago, Ill. U. S. patent 1,663,201 (March 20, 1928; expires 1945). No U. S. trademark.

Ampoules Bismuth Sodium Tartrate-Searle, 2 c.c.: Bismuth sodium tartrate-Searle, 0.03 gm.; benzyl alcohol, 0.040 gm.; sucrose 0.50 gm.; in water sufficient to make 2 c.c. Each ampoule contains more than 2 c.c. of solution.

Bismuth Sodium Tartrate-Searle, Glycerinated, 1.5 per cent.: An aqueous glycerine solution containing bismuth sodium tartrate-Searle, 0.015 gm.; benzyl alcohol, 0.02 gm.; glycerine, 0.5 c.c. and sterile distilled water to make 1.0 c.c.

Bismuth sodium tartrate-Searle is a finely divided, white powder, odorless and tasteless; permanent in air. The product is soluble in about three parts of water, except for a slight residue (0.1 per cent); the residue is soluble in sodium hydroxide solution. The aqueous solution is alkaline to litmus paper. When acid is added gradually to an aqueous solution of bismuth sodium tartrate-Searle, a precipitate is produced which dissolves on the gradual addition of an alkali.

Other tests for identity and purity of bismuth sodium tartrate appear on page 112 of New and Nonofficial Remedies, 1933.

DENTIFRICES[6]

DENTALINE TOOTH POWDER.—Composition: Each 100 gm. contains Castile soap, 8.4 gm.; precipitated calcium carbonate, 67.3 gm.; magnesium carbonate, 5.3 gm.; sodium bicarbonate, 5.3 gm.; boric acid, 8.4 gm.; wintergreen flavor, 4.8 gm.; resorcinol, 0.4 gm.; hydrastis, 0.1 gm.

Claims: The manufacturer has agreed to make no claims of a chemical, bacteriologic or therapeutic nature. Dentaline Tooth Powder is offered as a cleansing and polishing agent for the accessible surfaces of the teeth when used in conjunction with the toothbrush.

Manufactured by Ransom & Randolph Company, Toledo, Ohio. No U. S. patent or trademark.

ACCEPTED DENTAL REMEDIES

The following is a continuation of Accepted Dental Remedies. The Council will appreciate constructive criticism which will aid in future revisions of the material.

SAMUEL M. GORDON, *Secretary*

COD LIVER OIL AND RELATED SUBSTANCES

Cod liver oil has a favorable influence on the absorption and subsequent deposition of calcium and phosphate in the bones and in the teeth. Consequently, cod liver oil is considered to be among the medicinal foods which, because of their vitamin content, apparently have a beneficial effect on the development of teeth and aid in the prophylaxis against dental caries. The exact rôle that vitamin D plays in such prophylaxis is, at present, not clearly understood. [Diet and the Teeth, Reports of the Council, *J. A. D. A.*, 19:1843 (Oct.) 1932.] The substance called vitamin D, which is active in calcification, is associated with the unsaponifiable fraction of the oil and may be identical with the product formed by the irradiation of ergosterol.

Methods for determining the vitamin D content have not been sufficiently developed to warrant the adoption of a specified procedure for standardization at the present time. Manufacturers whose products are listed in Accepted Dental Remedies have adopted such methods as will enable them to indicate that their products are effective in the cure of experimental rickets, and they are therefore suitable for administration, and to be preferred to those brands whose potencies in respect to both vitamin A and D are not stated.

The beneficial properties of cod liver oil are due not alone to the presence of vitamin D. Cod liver oil also contains vitamin A (anti-ophthalmic), which possesses definite growth-promoting and anti-ophthalmic properties. In the presence of adequate quantities of vitamin D, the potency of the oil as regards vitamin A has only an indirect bearing on calcification.

The exact dosages for prophylaxis against caries by means of cod liver oil are not definitely

6. Dentifrices, J. A. D. A., 20:2076 (Nov.) 1933.

known. The standards adopted for New and Nonofficial Remedies, 1933, require not only a biologic assay for vitamin A, as demanded by the present edition of the Pharmacopeia, but also a method for vitamin D. These standards require that each gram of oil contain at least 400 units of vitamin A, when tested by the U.S.P. X method. The same standard is adopted for Accepted Dental Remedies, and the dosages given in the monographs for the individual brands are based on the curative properties against experimental rickets.

The chemistry and the biologic properties of the vitamins have been studied extensively. Detailed accounts can now be found in the newer textbooks on physiologic chemistry and nutrition.

COD LIVER OIL, U.S.P.—Oleum Morrhuae.—For description see the U. S. Pharmacopeia.

MALTINE WITH COD LIVER OIL.—Maltine 70 per cent and cod liver oil 30 per cent. Maltine is a preparation essentially similar to extract of malt, U.S.P., but it contains 3.88 per cent of alcohol and is prepared from malted barley, oats and wheat. As determined by a modification of the method of Chick and Roscoe, *(Biochem. J.,* 21:689, 1927), it contains one unit per gram (28 units per ounce) of vitamin B_1, one unit being the weight of this product necessary as the sole source of B_1 in an otherwise adequate diet to protect growing rats from polyneuritis and to assure normal growth; and one-third unit per gram (9 units per ounce) of vitamin B_2, one unit being the weight of the product necessary as the sole source of B_2 in an otherwise adequate diet to protect growing rats from pellagra, and to assure normal growth. One gram converts 5 to 7 grams of starch to maltose and dextrin in thirty minutes at from 40 to 42 C. One hundred cubic centimeters of maltine with cod liver oil contains not less than 28,000 fat-soluble vitamin A units as determined by the U. S. Pharmacopeia assay, and the product has an antirachitic potency such that 20 mg. fed daily to rachitic rats is sufficient to cause perceptible to distinct healing of rickets in from six to ten days as determined by the line test.

Prepared by the Maltine Company, Brooklyn, N. Y. No U. S. patent. U. S. Trademark 44,566.

MEAD'S NEWFOUNDLAND COD LIVER OIL.—It has a vitamin D potency such that one part in 400 parts of rickets-producing diet will initiate healing of rickets in five days. It is also required to have a vitamin A potency of not less than 700 U.S.P. X units per gram.

Manufactured by Mead Johnson and Co., Evansville, Ind. No U. S. patent. Name Newfoundland registered U. S. Trademark No. 298,166.

Mead's Newfoundland Cod Liver Oil, Flavored: Mead's Newfoundland cod liver oil, containing 0.12 per cent of a mixture of vanillin and oil of lavender as flavoring.

Mead's Newfoundland Cod Liver Oil complies with the U.S.P. standards for cod liver oil. In addition, it is required to have an antirachetic potency such that one part in 400 parts of a rickets-producing diet will initiate healing of experimental rickets in rats in five days (*J. Biol. Chem.,* 90:619, 1931). It is also required to have a vitamin A potency of not less than 700 units per gram, when assayed by the method of the U.S.P. X.

NASON'S PALATABLE COD LIVER OIL.—Cod liver oil containing 0.5 per cent of essential oils as flavoring, having a vitamin A potency as determined by the method of the U. S. Pharmacopeia of not less than 1,000 units per gm. and a vitamin D potency of not less than 150 units per gm. (equivalent to 190 A. D. M. A. units).

Dosage: For adults, 2 to 4 c.c. (30 to 60 minims), three times a day; for children, 1 to 2 c.c. (15 to 30 minims), three times a day.

Manufactured by Tailby-Nason Co., Boston. No U. S. patent or trademark.

Nason's Palatable Cod Liver Oil complies with the U.S.P. standards for cod liver oil. In addition, it is required to have a content of fat-soluble vitamin A, determined by the U.S.P. method, of not less than 1,000 units per gram, and an antirachitic potency of not less than 150 units per gram, the unit being defined as that amount which when fed daily for eight days will produce definite healing (as determined by roentgen-ray photographs) in the leg bones of rachitic rats in ten days, when added to a diet lacking in vitamin D, the rats being also deprived of ultraviolet light.

PARKE, DAVIS & COMPANY'S STANDARDIZED COD LIVER OIL.—It has a content of fat soluble vitamin A which is not less than 500 units per gram, and a vitamin D potency of not less than 133 units per gram.

Dosage: Infants, from 1 to 2 c.c. (15 to 30 minims); older children, from 2 to 4 c.c. (30 to 60 minims); adults, 4 c.c. (1 fluidrachm) or more, three times a day.

Manufactured by Parke, Davis & Co., Detroit. No U. S. patent or trademark.

Parke, Davis & Company's standardized cod liver oil complies with the standards of the U. S. Pharmacopeia. In addition, it is required to have a content of fat soluble vitamin A, determined by the method of the U.S.P., more than 500 units per gram (one unit being the amount required to correct both the induced xerophthalmia and retarded growth of young albino rats) and an antirachitic potency when determined by the method of McCollum, Simmonds, Shipley and Park (*J. Biol. Chem.,* 51:41, 1922) of

more than 133 units per gram (one unit being the amount of cod liver oil required daily to initiate recalcification in the leg bones of young albino rats).

PATCH'S FLAVORED COD LIVER OIL.—Cod liver oil containing less than 0.5 per cent of essential oils as flavoring and having a vitamin A potency of not less than 1,000 vitamin A units to the gram as determined by the method of the U. S. Pharmacopeia and a vitamin D potency of not less than 150 units per gm. as determined by the method of the A. D. M. A.

Dosage: 4 c.c. (1 fluidrachm) three times a day; for children, 2 c.c. (30 minims), three times a day.

Manufactured by the E. L. Patch Co., Boston. No U. S. patent or trademark.

Patch's flavored cod liver oil complies with the U.S.P. standards for cod liver oil. In addition, it is required to have a content of fat soluble vitamin A of not less than 1,000 units per gram as determined by the method of the U. S. Pharmacopeia, and an antirachitic potency, determined by a modification of the method of the American Drug Manufacturers' Association, of not less than 150 units per gram.

COD LIVER OIL WITH VIOSTEROL 10 D.—Viosterol dissolved in cod liver oil, the solution containing not less than 400 vitamin A units per gram, when tested by the pharmacopeial method, and 133.3 rat units of vitamin D per gram, this antirachitic strength being ten times that of a potent cod liver oil used as standard.

Actions and Uses: (See preceding article on viosterol.) Cod liver oil with viosterol 10 D is proposed for use in conditions in which it is desired to supplement the administration of vitamin A with that of vitamin D.

Dosage: For infants and young children, 2.5 to 3.3 c.c. (53 to 67 minims) daily; for adults and in severe cases, doses up to 7 c.c. (140 minims) or more are given.

Cod iiver oil with viosterol 10 D is prepared by the addition of irradiated ergosterol to cod liver oil in such proportion that the finished product will contain not less than 400 vitamin A units per gram when tested by the pharmacopeial method and 133.3 rat units of vitamin D per gram, the rat unit being that amount of vitamin D which, when uniformly distributed in the standard vitamin D deficient diet-ration 2965 (*Jour. Biol. Chem.*, 64:623, 1925), will produce a narrow and continuous line of calcium deposits in the metaphyses of the distal ends of the radii and ulnae of standard rachitic rats.

ABBOTT'S COD LIVER OIL WITH VIOSTEROL 10-D.—A brand of cod liver oil with viosterol 10 D, N.N.R.

Actions, Uses and Dosage: See Cod Liver Oil with Viosterol 10-D.

Manufactured by The Abbot Laboratories, North Chicago, under U. S. patent 1,680,818 (Aug. 14, 1928; expires 1945) by license of the Wisconsin Alumni Research Foundation.

Irradiated ergosterol, prepared by the method described under viosterol in oil 250 D-Abbott, is added to cod liver oil and the finished product is required to have a vitamin A potency of not less than 500 pharmacopeial units per gram and to have the vitamin D potency of cod liver oil with viosterol 10 D, N.N.R.

PARKE, DAVIS & CO.'S COD LIVER OIL WITH VIOSTEROL 10 D.—A brand of cod liver oil with viosterol 10 D, N.N.R.

Manufactured by Parke, Davis & Co., Detroit, under U. S. patent 1,680,818 (Aug. 14, 1928; expires 1945) by license of the Wisconsin Alumni Research Foundation.

Irradiated ergosterol, prepared by the method described under Viosterol in Oil 250 D. Parke, Davis, is added to cod liver oil and the finished product is required to have a vitamin A potency of not less than 500 pharmacopeial units and to have the vitamin D potency of cod liver oil with viosterol 10 D, N.N.R.

SQUIBB'S COD LIVER OIL WITH VIOSTEROL 10-D.—A brand of cod liver oil with viosterol 10 D, N.N.R.

Actions, Uses and Dosage: See Cod Liver Oil with Viosterol 10-D.

Manufactured by E. R. Squibb & Sons, New York, under U. S. Patent 1,680,818 (Aug. 14, 1928, expires 1945), by license of the Wisconsin Alumni Research Foundation.

Irradiated ergosterol, prepared by the method described under viosterol in oil 250-D Squibb, is added to cod liver oil and the finished product is required to have a vitamin A potency of not less than 500 pharmacopeial units and to have the vitamin D potency of cod liver oil with viosterol 10-D, N.N.R.

SQUIBB'S COD LIVER OIL WITH VIOSTEROL 10-D MINT FLAVORED.—A brand of cod liver oil with viosterol-10 D, N.N.R., containing 0.67 per cent of oil of spearmint as flavoring.

Actions, Uses and Dosage: See Cod Liver Oil with Viosterol 10-D.

Manufactured by E. R. Squibb & Sons, New York, under U. S. Patent 1,680,818 (Aug. 14, 1928; expires 1945), by license of the Wisconsin Alumni Research Foundation.

Irradiated ergosterol, prepared by the method described under viosterol in oil 250-D Squibb, is added to cod liver oil containing 0.67 per cent of oil of spearmint as flavoring and the finished product is required to have a vitamin A potency of not less than 500 pharmacopeial units and to have the vitamin D potency of cod liver oil with viosterol 10-D, N.N.R.

WHITE'S COD LIVER OIL CONCENTRATE.—A cod liver oil concentrate in the form of tablets (wafers), each containing not less than 685 vitamin A units and not less than 450 vitamin D units.

Actions and Uses: White's cod liver oil concentrate possesses properties similar to those of cod liver oil as far as these depend on the fat soluble vitamin content of the latter.

Dosage: For adults, from 2 to 4 tablets (wafers) three times daily; for children over 5 years, 1 tablet (wafer) three times daily, after each meal; for infants, 1 tablet (wafer) daily, crushed and dissolved in the feeding.

Manufactured and distributed by Health Products Corporation, Newark, N. Y., from concentrate prepared by White Laboratories, Inc., Gloucester, Mass. No U. S. patent or trademark.

White's cod liver oil concentrate is obtained from cod liver oil by separation of the unsaponifiable fraction of the latter under anaerobic conditions. The vitamin A potency of White's cod liver oil concentrate is determined by a modification of the U.S.P. X method, differing from the latter in the use of a ration containing agar, irradiated yeast, "crisco" and dextrin, and in placing the emphasis on xerophthalmia as the criterion for beginning the feeding of the concentrate. When assayed by this method, the product is required to have not less than 685 vitamin A units per tablet. Comparative assays using the preceding method and that of the U.S.P. X have shown the potency as determined by this method is fully the equivalent of that determined by the pharmacopeial method. The vitamin D unit is determined by finding the minimum quantity of concentrate which will produce in ten days a continuous line of calcium deposit on the metaphysial side of the epiphyseal cartilage of the tibias of rats made rachitic by means of vitamin D deficient diet 2965 (*Jour. Biol. Chem.*, 64, 263, 1925). When assayed by this method, the product is required to contain 450 vitamin D units per wafer.

HALIVER OIL WITH VIOSTEROL 250 D-ABBOTT.—Halibut Liver Oil with Viosterol 250 D-Abbott.—Halibut liver oil adjusted by the addition of maize oil to have a vitamin A potency of not less than 30,000 pharmacopeial units (U.S.P. X) per gram and by addition of a sufficient amount of viosterol in oil 250 D to assure a vitamin D potency of not less than 250 D (250 times that of the standard cod liver oil defined by the Wisconsin Alumni Research Foundation [or 3,333 units (Steenbock) per gram]).

Actions and Uses: The same as those of cod liver oil. (See general article, Cod Liver Oil and Cod Liver Oil Preparations.)

Dosage: At the present time, there is no basis for dosage of vitamin A and D products where caries and tooth health are concerned. There also are no accurate data available concerning the *direct* effect of vitamins A and D on the prevention of caries. Animal experiments indicate that vitamins A and D may be factors in the proper calcification of the teeth. Until more definite data are available, the dosage which follows, based on prophylaxis against rickets, is given:

For infants, 8 to 10 drops (3 to 3.5 minims) daily; for premature and rapidly growing infants, 15 drops (5.25 to 7 minims) daily; for adults, especially nursing and expectant mothers, 20 drops (7 minims) or more daily. The marketed preparation is accompanied by a special dropper designed to deliver approximately 3 drops to the minim.

Manufactured by the Abbott Laboratories, North Chicago, Ill. U. S. patent applied for. Trademark No. 294,692. The viosterol in oil 250 D used is manufactured under U. S. patent 1,680,818 (Aug. 14, 1928; expires 1945) and 1,871,136 (Aug. 9, 1932; expires 1949) by license of the Wisconsin Alumni Research Foundation.

Soluble Gelatin Capsules Haliver Oil with Viosterol 250 D-Abbott, 3 minims: Each capsule contains 3 minims of haliver oil with viosterol 250 D diluted with 3 minims of vegetable oil.

Haliver Oil with Viosterol 250 D-Abbott is prepared by combining halibut liver oil and viosterol in oil 250 D in such proportions that the finished product will have a vitamin A potency of not less than 30,000 pharmacopeial units (U.S.P. X) per gram, and a vitamin D potency of not less than 3,333 units (Steenbock) per gram. The halibut liver oil is assayed for vitamin A by the method described in the *Journal of the American Pharmaceutical Association* (19:616, 1930), and for vitamin D by the method of the Wisconsin Alumni Research Foundation (Viosterol, *J.A.D.A.*, 18:1785 [Sept.] 1931). The potency of the finished product is arrived at by a calculated dilution of the previously assayed oil though some batches are biologically assayed.

PARKE-DAVIS HALIVER OIL WITH VIOSTEROL—250 D.—Halibut Liver Oil with Viosterol 250-D.—Halibut liver oil adjusted by addition of maize oil to have a vitamin A potency of not less than 30,000 pharmacopeial units U.S.P. X) per gram, and by the addition of a sufficient amount of viosterol in oil 250 D to assure a vitamin D potency of not less than 250 D

(250 times that of the standard cod liver oil defined by the Wisconsin Alumni Research Foundation, or 3,333 units [Steenbock] per gram).

Actions and Uses: The same as those of cod liver oil. (See general article, Cod Liver Oil and Cod Liver Oil Preparations.)

Dosage: At the present time, there is no basis of dosage of vitamin A and D products where caries and tooth health are concerned. There also are no accurate data available concerning the *direct* effect of vitamins A and D in the prevention of caries. Animal experiments indicate that vitamins A and D may be factors in the proper calcification of the teeth. Until more definite data are available, the dosage which follows, based on prophylaxis against rickets, is given: for infants, from 8 to 10 drops (3 to 3.5 minims) daily; for premature and rapidly growing infants, 15 drops (5.25 minims) daily; for adults, especially nursing and expectant mothers, 20 drops (7 minims) or more daily. The marketed preparation is accompanied by a special dropper designed to deliver approximately 3 drops to the minim.

Manufactured by Parke, Davis & Company, Detroit. U. S. patent and trademark applied for. The viosterol in oil 250 D used is manufactured under U. S. patent 1,680,818 (Aug. 14, 1928; expires 1945) by license of the Wisconsin Alumni Research Foundation.

Soluble Gelatin Capsules Parke-Davis Haliver Oil with Viosterol—250 D, 3 minims: Each capsule contains 3 minims of haliver oil with viosterol 250 D, diluted with 3 minims of vegetable oil.

Parke-Davis haliver oil with viosterol 250 D is prepared by combining halibut liver oil, maize oil and viosterol in oil 250 D in such proportions that the finished product will have a vitamin A potency of not less than 30,000 pharmacopeial units (U.S.P. X) per gram, and a vitamin D potency of not less than 3,333 units (Steenbock) per gram. The halibut liver oil is assayed for vitamin A by the method described in the *Journal of the American Pharmaceutical Association,* (19:616, 1930) and for vitamin D by the method of the Wisconsin Alumni Research Foundation (Viosterol, *J. A. D. A.,* 18:1785 [Sept.] 1931). The potency of the finished product is arrived at by a calculated dilution of the previously assayed oil. Stability tests thus far reported indicate that the product will retain its potency when not exposed to extremes of light or of temperature.

VIOSTEROL

Ergosterol, one of the sterols present in the fat of ergot, yeast and other substances when subjected to ultraviolet irradiation develops an antirachitic (vitamin D) potency, as tested on rats, usually many times that of good cod liver oil.

The term viosterol has been adopted by the Council on Pharmacy and Chemistry of the American Medical Association to designate irradiated ergosterol.

In order to avoid the danger of hypercalcemia, the substance is diluted for therapeutic purposes in inactive oils, such as olive or maize, and is designated viosterol in oil. The terms 10 D and 250 D have been provisionally adopted to indicate that it has been diluted to 10 or 250 times the vitamin D potency of good cod liver oil. The product is assayed by the same method as is used for determining the vitamin D potency of cod liver oil.

The use of viosterol in the treatment of rickets is well established. Prolonged administration to insure adequate calcium absorption and deposition, or as a prophylactic measure against dental caries, is still in the experimental stage.

Danger of excessive deposition of calcium in the body with the quantities ordinarily prescribed for treatment is apparently remote. The substance does not contain vitamin A, and for that reason cod liver oil preparations are ordinarily preferable for prophylactic purposes.

VIOSTEROL IN OIL 250 D.—Irradiated Ergosterol in Oil. Activated Ergosterol in Oil.—Viosterol dissolved in a vegetable oil and standardized to contain 3,333 rat units of vitamin D in each gram, this strength being 250 times that of a potent cod liver oil used as standard.

Actions and Uses: (See preceding article on viosterol.)

Dosage: Daily prophylactic dose for the average infant and child, from 8 to 10 drops (0.1233 to 0.1666 c.c.; 2 to 3 minims); for the premature and rapidly growing infant, 15 drops (0.25 c.c.; 5 minims); daily curative dose, from 15 to 20 drops (0.25 to 0.333 c.c.; 5 to 7 minims). In severe cases and for adults, doses in excess of 20 drops may be given. The marketed preparations are accompanied by a standard dropper designed to deliver 3 drops to the minim.

Viosterol in oil 250 D is standardized by comparison with a potent cod liver oil containing in each 0.75 mg., 1 rat unit of vitamin D, the rat unit being defined as that amount of vitamin D which, when uniformly distributed into the standard vitamin D deficient diet-ration 2965 (*Jour. Biol. Chem.,* 64:263, 1925), will

produce a narrow and continuous line of calcium deposits in the metaphyses of the distal ends of the radii and ulnae of standard rachitic rats.

VIOSTEROL IN OIL 250 D-ABBOTT.—A brand of viosterol in oil 250 D, N.N.R.

Manufactured by The Abbott Laboratoris, North Chicago, under U. S. patent 1,680,818 (Aug. 14, 1928; expires 1945) by license of the Wisconsin Alumni Research Foundation.

Actions, Uses and Dosage: See Viosterol above.

Viosterol in oil 250 D-Abbott is prepared by dissolving ergosterol in anhydrous, peroxide-free ether, U.S.P. The solution is filtered, placed in transparent quartz containers with reflux condenser and exposed to ultraviolet rays at a determined distance and intensity for a determined length of time. The irradiated ergosterol, freed of ether and dissolved in sesame oil, is biologically assayed and adjusted to have the potency of Viosterol in oil 250 D, N.N.R.

Parke, Davis & Co.'s Viosterol in Oil 250 D.—A brand of viosterol in oil 250 D, N.N.R.

Manufactured by Parke, Davis & Co., under U. S. Patent 1,680,818 (Aug. 14, 1928; expires 1945) by license of the Wisconsin Alumni Research Foundation.

Parke, Davis & Co.'s Viosterol in Oil 250 D is prepared by dissolving crystalline ergosterol in purified ether to a definite concentration. The solution is then irradiated by exposure to ultraviolet rays from a lamp of the quartz mercury arc burner type. After irradiation, the ether is recovered and the ergosterol is dissolved in maize oil. The final dilution and the concentration is based upon the biologic assay and is adjusted to have the potency of viosterol in oil 250 D, N.N.R.

VIOSTEROL IN OIL 250-D, SQUIBB. A brand of Viosterol in oil 250-D, N.N.R.

Actions, Uses and Dosage: See Viosterol above.

Manufactured by E. R. Squibb and Sons, New York, under U. S. Patent 1,680,818 (Aug. 14, 1928, expires 1945), by license of the Wisconsin Alumni Research Foundation.

Viosterol in Oil 250-D, Squibb is prepared by dissolving ergosterol in ether. The solution is then irradiated by exposure to ultraviolet rays. After assay of the irradiated ergosterol for its antirachitic potency, it is dissolved in maize oil and adjusted to have the potency of viosterol in oil 250-D, N.N.R.

Iodine Compounds

Iodine compounds are used partly for their local irritant and antiseptic effects, which are due probably to the action of free iodine contained in the preparations or liberated from them, and partly for their systemic actions. They may be discussed separately under headings of "Iodine preparations containing free iodine," "Iodine dusting powders" and "Iodine compounds for internal use." The latter group have no direct interest in dental therapeutics, except as matters of general interest, as systemic actions may occur from local absorption of iodine and as conditions which might be benefited by the administration of iodine in some form.

From time to time, iodine containing preparations in solution have been introduced into dentistry and medicine with the claims that these lacked disadvantages attributed to tincture of iodine. In most or nearly all cases, it may be concluded that the manufacturers have never possessed any comparative data to indicate the claimed advantage of these water soluble iodine preparations over the official preparations: tincture of iodine or liquor iodi compositi (Lugol's solution) *properly diluted* to give an equal free iodine content. Sollmann (*J. A. D. A.*, 73:899, 1919) stated, after a comparative study of several: "The presence of potassium iodide in the official tincture does not seem to render this preparation more irritant. On the contrary, it is somewhat less irritant to the skin, and much less precipitant to proteins, than the simple alcoholic tincture, or the secret and nonsecret 'miscible tinctures.' The more even spreading and more rapid coagulation of protein render the simple alcoholic solution of iodine probably the best for the 'disinfection' of the skin, while the delayed protein precipitation by the U.S.P. tincture would probably render this somewhat superior for the disinfection of open wounds. The secret and nonsecret 'water soluble tinctures' do not appear to have any material advantages." The foregoing statements may be directly applicable to dental conditions.

Iodine Preparations Containing Free Iodine

IODINE, U. S. P.—Iodum (I).

Properties: Iodine is a heavy, bluish-black, dry and friable solid, crystallizing in rhombic plates. It has a metallic luster, a distinctive odor and a sharp and acrid taste. It is readily volatile. It is slightly soluble in water (1:2,950), but soluble in alcohol (1:10), chloroform, ether, and solutions of iodides.

Incompatibilities: Iodine is incompatible with alkalis and alkaline carbonates, alkaloids, tannins and other vegetable astringents, and with most volatile oils, particularly the terpene-containing oils.

Actions and Uses: All iodine preparations, whether elemental, inorganic or organic, when taken internally are convertible into thyroxin and are eventually excreted as iodides. Large doses cause iodism.

Elementary iodine is converted to iodides, but first combines with the cell proteins; therefore, it has local irritant and antiseptic actions. Elementary iodine combines with protein to form loosely bound compounds. Therefore, the action of iodine extends deeply. Iodine in the form of the tincture is widely used as a skin disinfectant. The action on mucous membrane is more severe than that on the skin and may produce corrosive effects. The presence of potassium iodide, as in the official tincture and Lugol's solution, delays precipitation, and hence favors penetration. It is therefore better for wound disinfection.

Iodine is largely used in dentistry for its local antiseptic action, also as a disclosing stain, to reveal the presence of so-called mucin plaques.

Secretion of saliva is not normally affected by iodine secretion, but inflammation of the parotid gland is one of the manifestations of iodism.

Besides the official preparations, compound solutions of iodine and tincture of iodine, several modifications have been used in dentistry. Churchill's solution of iodine in conjunction with a solution of silver nitrate has been suggested for the treatment of trench mouth.

COMPOUND SOLUTION OF IODINE, U.S.P.—Liquor Iodi Compositus. (Liq. Iodi Com.) Lugol's solution. One hundred cubic centimeters contains about 5 gm. of iodine and about 10 gm. of potassium iodide in distilled water. "Churchill's iodine caustic" is approximately five times more concentrated that Lugol's solution. Iodine, 4 gm.; potassium iodide, 8 gm.; water, 16 c.c.; mix.

TINCTURE OF IODINE, U.S.P.—Tincture Iodi (Tr. Iodi.)—One hundred cubic centimeters contains 7 gm. of iodine and 5 gm. of potassium iodide dissolved in distilled water and mixed with alcohol. It can be diluted with water to give solutions containing relatively lower concentration of iodine.

Tincture of Iodine, U.S.P., 2 parts; with acetone 3 parts, and glycerine, 1 part, has been suggested as an efficient and nonirritant antiseptic, preliminary to puncturing or cutting oral mucosa (*D. Cosmos*, 73:74, 1931).

LIQUOR IODO AND ZINC PHENOLSULPHONATE, N.F.V.—Iodine, 20 per cent; potassium iodide, 15 per cent; and zinc phenol-sulphonate in a mixture of glycerine and water, was formerly used as a so-called "pyorrhea astringent." (The Council desires to point out that the use of such terms as "pyorrhea astringent," etc., is irrational. Rational therapeutics is best advanced by designating the composition of drug preparations by appropriate chemical names. There are a number of so-called pyorrhea astringents in dentistry, and unless proper nomenclature is used, confusion is easy. It should be also remembered that one drug may have a number of uses besides the purely specialized use in dentistry.)

Iodine Dusting Powders

Dusting-powders containing iodine in various combinations are widely used in the treatment of wounds, granulating surfaces, abscess cavities, etc. The virtue of such preparations was formerly attributed to a germicidal action, but investigators have found such action very slight. The clinical results are now ascribed to a slight antiseptic action of the iodine, to a stimulation of phagocytosis, and to a diminished secretion of the wound which renders it a less favorable culture medium for germs.

Iodoform has been the standard drug of this class. Other insoluble organic compounds have been introduced to replace iodoform, but with limited success. While they avoid the disagreeable odor and the occasional toxic systemic effects, they also lack much of the efficiency.

IODOFORM, U.S.P.—Iodoformum (Iodof.) CHI_3. Tri-iodomethane. It is usually prepared by the action of iodine on alcohol or acetone in the presence of an alkali or alkali carbonate.

Properties: Iodoform occurs as a fine, lemon-yellow powder or lustrous crystals having a peculiar, very penetrating and persistent odor, and an unpleasant, slightly sweetish and iodine-like taste. It is very slightly soluble in water (1:10,000), soluble in alcohol (1:60), and very soluble in ether (1:7.5). It is somewhat soluble in fixed oils.

Incompatibilities: Iodoform is incompatible with mild mercurous chloride (calomel), silver salts, chlorates and nitrites.

Actions and Uses: Iodoform is a mild local analgesic, antiseptic and stimulant. When absorbed freely through the skin or from denuded surfaces, it produces intoxication, which is not evident until after a lapse of some time. When swallowed, it is partly decomposed with the formation of iodides, which produce their ordinary effects. Part of the drug is absorbed in a form of combination not yet understood, and produces symptoms that are different from those ordinarily caused by iodine. The symptoms are restlessness, anesthesia, sometimes unconsciousness, occasionally convulsions, hallucination and delusions of persecution, rapid pulse and elevated temperature, collapse and coma. Death may follow. Iodoform is excreted slowly, iodine compounds appearing in the urine for several days after a single dose. It is employed as a mildly antiseptic and analgesic dusting powder for open wounds. It has been and still is used in the treatment of putrescent pulp canals, as a dressing for ulcers, deep-seated pockets and purulent antrums. It is said to be useful in the form of a 5 to 10 per cent gauze packing. The permanence of the odor has made it objectionable. It is still incorporated in some root filling materials, which appears to be an irrational practice.

Dosage: Iodoform is usually applied externally in the form of a dusting powder, but it may be used in the form of a suspension, as an ointment or as a surgical dressing in the form of gauze impregnated with the drug.

THYMOL IODIDE, U.S.P.—Thymolis Iodidum (Thymol. Iodide). A mixture of iodine derivatives of thymol, principally dythymol-dioxide. [$(C_6H_2CH_3C_3H_7OI)_2$]

Properties: Thymol iodide contains, when dried, over sulphuric acid, not less than 43 per cent of iodine. It occurs as a bright chocolate colored, or reddish yellow, bulky powder, with a very slight aromatic odor. It is practically insoluble in water and slightly soluble in alcohol.

Actions and Uses: Thymol iodide is antiseptic and is used in place of iodoform, chiefly as a dusting powder. It is incorporated in several permanent root filling materials, which appears to be an irrational practice.

Aristol: A brand of Thymol Iodid, U.S.P.

Manufactured by Winthrop Chemical Co., Inc., New York. U. S. trademark 17,393.

Iron and Iron Compounds

The principal use of iron and iron compounds in general therapeutics is as a hematinic. Less frequently, it is used as an astringent and as a styptic, which accounts for its place in dental therapeutics. The latter actions are due to the properties which it possesses in common with other metallic ions of action on, or precipitating, protein material to form insoluble compounds. Iron is essentially different from most other heavy metals in being necessary to the life of perhaps all forms of protoplasm. It forms an essential part of the hemoglobin molecule.

The forms of iron which are of principal use in dentistry are those in which iron occurs in the ionic form. Such compounds listed in A.D.R. are ferrous sulphate, ferric chloride and ferric subsulphate (Monsel's solution, N. F. V). In general therapeutics, it is used (1) in the form of metallic or elementary iron (reduced iron, U.S.P.); (2) in the ferrous or unoxidized form, responding to tests for the ferrous iron (ferrous carbonate in mass and pills of ferrous carbonate and ferrous iodid in syrup of ferrous iodid); (3) in the trivalent or oxidized form the ferric compounds, responding to tests for the ferric ion (ferric chlorid in tincture of ferric chlorid, U.S.P.) and complex compounds of iron.

The reduced iron and several of the carbonate preparations are used exclusively in the treatment of anemia, as they are practically devoid of irritant properties and are among the best of all iron preparations for this purpose.

Complex iron compounds are those compounds of iron whose solutions do not respond to the common tests for ferrous or ferric ions, because the iron is part of a radical; nor do they have the astringent properties of the simple iron solutions. Hence, for the purposes of astringency, their use appears irrational.

Actions and Uses.—Solutions of ferric iron have been used extensively. Iron salts, notably ferric subsulphate (Monsel's solution), have been used extensively in dentistry as astringents. On account of their property of staining teeth, they can be replaced with advantage by less harmful astringents, such as epinephrin or thromboplastin. In profuse hemorrhage, their efficiency as a coagulant is low.[7]

7. Hanzlik, P. J.: J. Pharm. & Exper. Therap., 12:71 (Sept.) 1918.

The perchloride and the subsulphate are used as styptics and act by precipitating the proteins of the blood, thus forming an obstruction to the flow of blood from the wounded vessels. Such treatment is of value only for oozing from capillaries or small arterioles. To be effective, the iron must be brought in immediate contact with the bleeding point.

As already indicated, the principal use of iron is in the treatment of certain forms of anemia and chlorosis. As certain of the ferric salts readily destroy the enamel and cause a pronounced black coloration of the teeth, the ferrous salts are to be preferred for this purpose. Reduced and ferrous iron do not destroy the teeth.

Because of improvement in general hygiene in later years, chlorosis has become an increasingly rare disease. Suitable diet (especially liver, kidney, meat and spinach) is sometimes more effective than the iron preparations alone, presumably through the interplay of other factors, probably organic in nature, since liver extract, which is practically iron free, is of no value in secondary anemia, although effective in pernicious anemia.

There is no adequate evidence that iron compounds, either simple or complex, are related to the problem of calcification, as asserted by some authors. The intake from food sources is ordinarily more than sufficient for the needs of the average person.

FERRIC CHLORIDE, U.S.P., Ferri Chloridum (Ferr. Chlor.).—Iron Perchlorid, Sesquichlorid of Iron.—Ferric Chloride—$FeCl_3$ with water of hydration.

Properties: The orange-yellow crystalline deliquescent pieces are odorless, and have a strongly styptic taste. They are readily soluble in water (1 in 0.2), and freely soluble in alcohol.

Incompatibilities: It is incompatible with tannin, the vegetable astringents (which give an inky color to the mixture), and with alkalis and alkali carbonates. Tincture of ferric chloride is also incompatible with iodids, from which it liberates iodin.

Actions and Uses: In medicine, it is used mainly in the form of the tincture. It is an astringent and is used in application to the mucous membranes, particularly of the throat. It is used in the control of hemorrhage, after the extraction of teeth, the removal of small growths, etc. It may be employed as a hematinic, but often disturbs digestion. The tincture has a deleterious effect on the teeth and hence should be used with caution.

Dosage: As an astringent, it is taken in substance or in tincture.

TINCTURE OF FERRIC CHLORIDE, U.S.P., Tinctura Ferri Chloridi (Tr. Ferr. Chlor.).—Tincture of iron. A hydro-alcoholic solution of $FeCl_3$, containing about 13 per cent of the anhydrous salt, corresponding to not less than 4.48 per cent of metallic iron (Fe).

Properties: Tincture of ferric chloride is a bright amber-colored liquid having a slightly ethereal odor, a very astringent taste and an acid reaction. It is miscible in all proportions with either water or alcohol.

FERRIC SUBSULPHATE, Ferri Subsulphas (Ferr. Subsulph.).—Monsel's salt. This is used in dentistry principally as solution of ferric subsulphate (N.F.V) Monsel's solution.

Liquor ferric subsulphate (Liq. Ferr. Subsulph.).—An aqueous solution of ferric subsulphate, containing about 20 gm. of Fe in each 100 c.c.

Properties: Monsel's solution is a dark, reddish brown liquid, odorless or nearly so, of an acid, strongly styptic taste, and miscible with water and alcohol without decomposition.

Incompatibilities: It forms insoluble compounds with tannin and tannic acid, hydroxides and sulphides and, in general, with metal precipitants.

Action and Uses: Monsel's solution acts as a prompt styptic. As such, it has been used in dentistry for the control of hemorrhage after the extraction of teeth. The solution may be soaked in cotton for packing in the socket, after washing. It should not be used internally.

FERROUS SULPHATE, U.S.P., Ferri Sulphas (Ferr. Sulph.).—Green Vitriol.—$FeSO_4.7H_2O$.

Properties: Ferrous sulphate occurs as pale, bluish-green crystals, without odor, having a saline, styptic taste. It is efflorescent in dry air. It is freely soluble in water (1 in 1.4).

Actions and Uses: In common with other metallic salts, and iron salts in particular, iron sulphate is an active astringent. It is claimed to be inferior to copper sulphate for application to canker sores. It may be applied in substance or solution.

It is sometimes administered in pills as a hematinic. It was formerly used as a disinfectant and deodorant, but is not often employed for that purpose now.

Dosage: As an astringent, in substance or in solution, when it is given internally, the dosage is 0.1 gm. (1½ grains).

BUREAU OF PUBLIC RELATIONS

DENTAL CARE OF NEEDY CHILDREN: THE BRONX PLAN

By the Joint Committee of the Bronx Dental Societies and the Bronx Tuberculosis and Health Committee of the New York Tuberculosis and Health Association, New York City

UNCARED for dental defects among needy children, many of which are the result of nutritional deficiency, are part of the backwash of poverty growing out of four years of depression. Dental care of growing children, one of the objectives of public health campaigns, now becomes one of even greater importance when, to the neglect which grows out of sheer carelessness—part of which can always be reached by education—is added the neglect which cannot be touched by the persuasiveness of the health educator.

Neglect of dental care of growing children which is forced by reduction or disappearance of income becomes at once a more acute problem for relief agencies as well as for the public health agency. Uncared for dental defects leave a scar which will mar the health and happiness of the afflicted child throughout his whole life period. Able though he may be as an adult to overcome most of the evils of present parental misfortune, thousands will find themselves facing problems of health in even early adult life which can be prevented now only by providing means for meeting the dental care of needy children—children whose parents, many of them, in normal times would have found means to meet the problem.

While, of course, this is part and parcel of the whole problem of malnutrition, underdevelopment and underprivilege, depression's toll on childhood, the dental care of the needy child requires a somewhat specialized handling owing in part at least to the comparatively recent arrival of dentistry in the child health program and the relatively meager facilities available in the way of free clinics for treating needy children.

Much has been written concerning the need of increasing the number of dental clinics and the need for health insurance measures to meet the cost of dental care. Experiments have been tried countrywide, but notwithstanding the agitation, there remain hosts of citizens without needed care. The depression, as other social problems, now emphasizes the need to the point where emergency measures must be adopted to meet it.

Previous to 1929, campaigns for dental care were carried on widely. In the Bronx, the schools particularly were made aware of the importance of good dentition as a health asset. Talks on dental care were given before assemblies; posters were widely distributed; moving pictures were shown; pamphlets were sent to parents; the school teachers and nurses wrote notes to the effect that "Johnny should go to his dentist."

In 1929, it was possible for people to

pay for the care of the teeth; whereas, in the four succeeding years, the problem of getting such attention has become increasingly difficult. The number of destitute families, and those existing on a marginal basis, has caused schools and health agencies to regard the problem of dental care, particularly for the growing child, as a most serious one. In this borough of the Bronx with its population of a million and a quarter, with 250,000 school children and 100,000 additional under 5 years, and with very limited publicly administered dental clinics, the question seemed insoluble.

For instance, there are eight dental clinics for treatment in the 100 public and fifty parochial elementary schools, in addition to which there are four schools with provision for dental prophylaxis. In 1932, in these clinics, 3,308 children were newly registered and 2,482 reregistered; a total of 5,790 out of the total school population treated in school clinics. An additional 2,789 were given prophylactic treatment only. It should be remembered, too, that the policy of the dental bureau of the department of health is largely preventive and, for that reason, the service is supposedly given only to those children up to and including the fourth grade.

Children leaving school who, in order to get their working papers, must have dental defects remedied and who have no means of paying the dentists have, up to this spring, had recourse to the dental clinics of the municipal hospitals. This service in the hospitals, as an economy measure, has been restricted to extractions only, with treatment for their own patients. Here is a situation: Children in needy families hoping for work cannot get their papers unless their teeth are in order: there is no money to pay for such service; therefore, no job is open to them: a vicious circle indeed. The same situation is true of high school students who are required before graduation to have all remediable physical defects corrected as a practical part of their course in hygiene. Those who could not afford to pay for dental care were penalized through no fault of their own or of their parents.

The Bronx Tuberculosis and Health Committee, a local health promoting agency, had been showered with appeals for assistance, not only from these sources but also from other health and welfare agencies.

When, early in 1932, a committee of the Bronx County Dental Society Branch of the First District Dental Society offered to the Bronx Tuberculosis and Health Committee local assistance in this problem, this generous offer was received with much enthusiasm. A committee of the dental society was appointed to discuss with a similarly appointed committee of the Bronx Tuberculosis and Health Committee a possible plan which would give dental service to children in needy families while safeguarding the dentists from exploitation.

The dentists of the society were canvassed as to their willingness to participate in a program which would provide dental treatment for needy children of school age without cost. This policy of "no fee" was decided on after careful discussion and deliberation. It was the dentists' opinion that a "needy" family could not and therefore should not be asked to pay; furthermore, that a small fee might give a false impression of the value of the dentist's operations, particularly when it was considered that these patients might well be future prospective private clients, and that those able to pay a moderate fee should endeavor to obtain private dental treatment at the rate they could afford to pay. The fee of 25 to 50 cents, recommended by the Community Dental Health Service of the New York Tuberculosis and Health Association, would

have a tendency to jeopardize the Bronx dentists' private practice by causing ill-feeling on the part of his private patients. This situation is due to the fact that this borough is made up of "neighborhoods," with the accompanying intimate relationships. It was further decided that the dentist could refuse any patient whom he thought ineligible for this care or he could request a reinvestigation of the family's ability to pay for service in case of doubt.

The Joint Committee decided to try out the plan for a six months' period. It limited the applications for such care to one of the high schools which could provide an investigating service to determine the family's financial status, and to one health agency, whose home visits provided a similar control. Responsibility in regard to making appointments and to assuring equable distribution of patients among the dentists was to be carried in the office of the Bronx Tuberculosis and Health Committee. Dentists were to make decisions as to diagnosis and treatments, and extractions were made in the office or a clinic as the dentist decided. The object of the work would be to put the student's mouth in a state of health through necessary fillings, prophylaxis and other treatments.

A list of dentists agreeing to participate, with their addresses and telephone numbers, was compiled and referred with the following suggestions for procedure outlined to the high school and health agency.

PROCEDURES TO BE FOLLOWED IN RECOMMENDING APPLICANTS FOR FREE DENTAL SERVICE

1. Provided it has been ascertained that the child is absolutely unable to pay for dental care and is entitled to free treatment, have the parent select one dentist from three names of dentists in the neighborhood.

2. Have the parent sign the *request* for treatment, writing in on the card provided the name of the dentist selected. Fill out the card as far as is possible: name of dentist and his address; child's name, age and sex; referring agency and worker's signature.

3. The appointments will be made by the Bronx Tuberculosis and Health Committee in order to prevent the overlapping of agencies and the overloading of any one dentist. It is extremely important that in case any child is unable to keep an appointment, the dentist be notified immediately. No further appointment will be made where appointments are broken carelessly. (It is obligatory that this attitude be taken to conserve the dentist's time.) The card should be given the student or family with instructions as to how to get to the dentist's office, impressing on them that they must be there at the time appointed.

4. Each card has a number to identify it. Keep the number with the record of the child's name. We suggest that you have a double page record book ruled thus:

(Left Hand Page)

Date—First Appt.	Case No.	Name	Referred to

(Right Hand Page)

Fillings	Extractions	Prophylaxis	Comments	Date Closed

Reports on completed cases will be sent monthly.

A letter was then sent to the cooperating dentists stating that within a brief time they would receive requests for appointments, and that the patient would present the referal card with the signed request of the parent. It also asked him to return the post card on completion of treatment, filling in the data (see second card).

After six month's experience, it was evident to the committee that the plan was practical; the abuses were very rare,

and the cooperating dentists and the students were more than satisfied. Ten months after the initiation of this work, a second group of dentists, the Northern District Dental Society, suggested that a number of their members were anxious to participate in this plan for dentistry for needy children. With this additional group, this service was extended to the other high schools and at the end of the first year, it is possible to report that one hundred dentists in the borough, members of the Bronx County Dental Society Branch of the First District Dental So-

551

FIRST CLASS
Permit No.....
New York, N. Y.

BUSINESS REPLY CARD
No postage stamp necessary if mailed in the United States

2c POSTAGE WILL BE PAID BY
Joint Committee of the
Bronx Dental Societies and the
Bronx Tuberculosis and Health Committee
4751 Park Avenue
Bronx, New York

I, parent or guardian of.....
request dental treatment for him / her and assume responsibility for the same.

Signature.....

Address.....

The dentist will retain this card for his file.

551

DENTISTRY FOR CHILDREN CAMPAIGN

When the patient's work is completed, the dentist is asked to detach and mail this report to the Committee in order that a record of work accomplished may be kept.

Age.... Sex..... Referred by.....

Fillings deciduous / permanent Extractions deciduous / permanent

Prophylaxis Other treatment

Dentist..... Address.....

551

Joint Committee of the
Bronx Dental Societies and the
Bronx Tuberculosis and Health Committee
4751 Park Avenue
Bronx, New York

To:..... Address.....

This will introduce.....
(child's name)
who is in need of dental service.

Appointment: Day..... Hour.....

.....
(referring agency) (Worker's signature)

551

Note: The parent's signature and the referal card remain in the dentist's file (right). The record on treatment is sent to the Joint Committee (left).

Copy of four faces of double post card used as referal card; adopted from the referring card of the Committee on Community Dental Service of the New York Tuberculosis and Health Association.

ciety, and the Northern District Dental Society, have or have had under treatment more than 500 children in their own private offices.

At the end of the year's work, the Joint Committee of the Bronx County Dental Societies and the Bronx Tuberculosis and Health Committee were able to report as follows:

Patients referred for dental care	558
Patients with treatments completed	271
Fillings	1294
Extractions	232
Roentgenograms	32
Prophylaxes	231
Other treatments (root canal fillings, etc.)	53

The records for the foregoing data have been taken from cards returned to us by the dentists.

As it is impossible to compute the value of the service because of divergence in fees, it was suggested that the fees recommended by the bureau of extension of dental service be applied to this finished work. These fees are supposed to represent the cost to the dentists for their services only; i.e., overhead, time and materials.

Prophylaxis—231 at $2	$462
Roentgenograms—32 at $3	96
Extractions—232 at $1	232
Fillings—1,294 at $3	3,782
Root canal fillings, etc., 53 at $7	371
Total	$4,943

The contribution of the dentist is more than $18 per student.

In addition to this cost, that to the Bronx Tuberculosis and Health Committee must be added. Telephone calls, supplies (cards, books, etc.), postage, and service, which includes time of the clerical staff only, it being impossible to estimate the time spent by the executive secretary, total $446.65. The dental work of 568 students therefore costs approximately $19 per student; the average number of treatments being 7.03, including fillings, prophylaxes and other treatments.

It might be of interest to know the ages of 206 of these patients in view of the already noted policy of the department of health; that is, school dental treatment to fourth grade only. This information is given in the accompanying tabulation.

Age of patient Years	Number Treated
5	1
6	3
7	4
8	8
9	8
10	7
11	5
12	9
13	11
14	19
15	39
16	24
17	11
18	2

High school students (age unknown) 51; (all high school, 146). Elementary school students (age unknown) 4; (elementary children, 60). Total 206.

The closing of the schools has given time to review the situation in preparation for the fall work. The committee plans to interest other dentists in the project and thus provide for an increase in the service. Dentists who did not volunteer previously might be interested in doing so now, as the past year has demonstrated that a service of such importance can be given by the dentists in their own offices with a minimum of effort on their part but contributing munificently to the health of the children of the borough who would otherwise be not only needy but also neglected.

SURVEY OF DENTAL DIAGNOSIS

DURING CHILDHOOD

	TEMPERAMENT	GENERAL HEALTH	HABITS	DIET	ABNORMALITIES	OCCLUSION	SOFT-TISSUES	HARD-TISSUES
5th TO 9th MONTH OF FETAL LIFE EXPECTANT MOTHER	A happy disposition in the expectant mother is conducive to proper environment for the unborn. Happy environment for the expectant mother is conducive to proper reactions.	Normal physiological functioning of the expectant mother is vital to the welfare of every developing organ in the fetus. The mother's ill-health may result in hypoplasia of the deciduous teeth. The counsel of a good physician is very necessary at this time.	Well regulated habits in general hygiene are vitally necessary to the well-being of the expectant mother and argues well for good fetal environment.	Select diet carefully. Protects expectant mother's health and insures normal bone and tooth development in fetus. Vitamins and minerals are very important. Milk, leafy and green vegetables, fruits, eggs, etc., are fundamental. Cod-liver oil, ergosterol, ultra-violet radiation is essential.	There are possible hereditary influences to be borne in mind as regards the progenitors.	Hereditary influences may result in faulty occlusion in the offspring. Lower prognathism are must apt to be a result of heredity.	Focal infections may impair normal physical functions of mother or directly affect the fetus. May also cause hypoplasia of the deciduous teeth.	Good teeth of progenitors are most essential and have a favorable hereditary influence upon the teeth of the offspring.
FIRST 9 MONTHS BREAST FED	The above still holds true. Baby's surroundings, also should be pleasant. Even at this age behaviorisms are forming, and mild obedience should be enforced.	Ill-health, in either mother or child, may upset the mineral supply to the developing permanent teeth, producing a hypoplasia.	Most of the abnormal sucking habits can be corrected at this age. Check any other habits to enable their correction at the proper time.	Same as above, for mother. For child also: prepared and served as per age requirements. Counsel of good physician is helpful at this time. Sunlight and other types of stimulation to calcium metabolism are important in this period.	Cleft palate, harelip, and other gross malformations need operative interference	See "HABITS."	Instruct in proper hygiene of baby's mouth. Watch for symptoms of mild scurvy. Watch for acute infections, gonorrhea, Vincent's disease, and stomatitis	Check on teething. Lancing may be a necessary procedure to aid teething. Correct defects, as hypoplasia. Begin hygiene of teeth as soon as they appear. Avoid bad influence of starchy and sweet foods-sulfa.
FIRST 9 MONTHS BOTTLE FED	A great, normal experience of motherhood is lost in these cases, and the magnificence of that emotion should be substituted in the tenderness of some other form of mother love.	The above still holds true, excepting, of course, any influence of the mother. Guard against rickets, and diseases attended by temperatures. They frequently leave their marks upon developing permanent teeth.	Do not permit the baby to use nursing nipple as a pacifier. Same as above in other matters.	Same general suggestions as above prevail. The counsel of a good physician is of utmost importance in these cases. Frequent check-up on diet is indicated to avoid digestive and metabolic upsets. Watch for food idiosyncracies.	Same as above	See "HABITS."	Same as above.	Same as above, except that emphasis should be for more rigid hygiene.
9 MONTHS TO 4 YEARS	Definite training in obedience should be accomplished at home, if not, it may become necessary to use force in the office management of the child. Kindness and sympathy should prevail, with no coddling or coaxing.	The above suggestions still prevail. These are the most important years for developing permanent teeth. Avoid contagious diseases. Health check-ups are advisable. Hypoplastic central incisors, cuspids, and first permanent molars develop at this time.	Complete the correction of all unnatural sucking habits. Treat severe breathing habits. Guard against injurious sleeping postures, and tongue habits. Encourage proper habits of chewing. Teach correct habits in mouth hygiene.	Same suggestions as above. Developmental needs from food standpoint require careful supervision. Select chewy foods. Limit sweets and pastries. This is most important time in developing permanent teeth.	Check for abnormalities that may have been overlooked or neglected during infancy. Observe size of tongue.	Begin correction of 3rd class occlusions. Minor errors may be corrected by proper grinding. Use of space retainers is very necessary upon unnatural loss of teeth.	Infections about teeth may affect permanent teeth. May cause systemic involvements, especially of heart, kidney, blood. Observe for symptoms of anemia, rheumatism, scurvy. Institute strict hygiene.	Institute early treatment of faulty enamel or exposed dentine. Early detection and filling of small cavities is imperative. Give proper attention to pits and fissures. Strict mouth hygiene must be carried out.
4 YEARS TO 9 YEARS	Be truthful with the child. Always be kind, but firm. There are formative years. Study the types and fit the treatment to the needs. By right approach and careful operating a child may be moulded into a model patient.	The above statements here apply largely to the developing bicuspids and second molars. Watch for evidence of effects from focal infections on kidneys—heart. Observe for symptoms of anemia and rheumatism.	These are most important years as regards formative influences on bony structures of the face. Watch for and correct all bad habits, including lip habits. This is the most important period for development of proper mouth hygiene habits.	Same suggestions as above. Is important age in the developing cuspids, bicuspids, and second molars. Is a very important period in the growth of the bony arch.	Correct abnormal attachment of labial frenum, especially between 7th and 9th year. Check, with X-Ray, unerupted or missing teeth. Watch for supernumerary teeth.	Space retainers are very important at this age. This is best age to intercept malocclusions. 6 to 9 years is best age to correct rotations and jump single teeth into occlusion, correct 3rd class and variations of class 1 occlusions.	Same as above, but now more important. Properly care for gum-flaps over erupting molars. Give attention to hypertrophied tissues. Acute and chronic gingivitis, or stomatitis demand careful attention. Strict hygiene is necessary.	Above suggestions are still very important. Watch eruption with special attention to first permanent molars. May be necessary to build up first permanent molars. Grind and polish faulty enamel. Strict mouth hygiene.
9 YEARS TO 12 YEARS	You may reason with this group. You may appeal to their sense of pride. Frankness and explanations are of assistance. Operate carefully, avoid pain. Be a pal.	Check at this age for abnormalities of soft tissues. Guard against effects on general health by infected soft tissues. The heart is now developing rapidly and requires every precaution to protect it.	The above suggestions apply. These are most important years for orthodontic treatment. Bony structures are now becoming fixed. Necessary corrective muscle training is now available. Broaden mouth hygiene instruction.	Previously mentioned points in diet still apply. Emphasis should be laid upon factors encouraging normal bone development.	Check, clinically and by X-Ray, missing and supernumerary teeth. Observe for impaction of cuspids. Check as to normality of shedding and eruption of teeth.	This is the most important age for the correction of all classes of malocclusion. In certain malocclusions grinding is very helpful. Correction of malocclusion at this age obviates long use of retaining appliances. See "ABNORMALITIES."	There is possibility of gingivitis resulting from salivary deposits. Guard against all types of infections. Dangerous to general health. See "above." X-Ray check-up is desirable in such conditions. Institute strict hygiene.	Watch influence of diseased deciduous teeth upon permanent teeth. Check size of pulps in cavity preparation. Use X-Ray. Extension for prevention should be practiced. Strict mouth hygiene.
12 YEARS TO 15 YEARS	Greater consideration must be shown this group. Peculiar demands of adolescence require it. Use more care, even resorting to extreme kindness. Avoid painful operations during nervous periods.	During these years many changes are taking place and a healthy mouth is most conducive to well-being.	Habits still affect bone formations of face, favorably or unfavorably. It is rather late for corrections. Appliances are usually required.	There are complications of adolescence that necessitate watchful care and patience.	Same as above.	It is late for ready correction of most malocclusions, but still possible and ideal in some. Check, with X-Ray, cuspids and second molars.	Take special note of gingivitis tendencies. Determine etiology of persistent gingivitis and correct as soon as possible to prevent pyorrhea development. X-Ray check-up is desirable. Strict hygiene is necessary.	Same as above. Give proper attention to pits and fissures on second permanent molars, especially in mouths susceptible to caries. Strict mouth hygiene.

Prepared by F. Blaine Rhobotham, D.D.S., Chicago

Distributed by The Bureau of Dental Health Education, American Dental Association, 58 E. Washington St., Chicago, Ill

Approved by American Society for the Promotion of Children's Dentistry

THE BUREAU OF PUBLIC RELATIONS OFFERS "A SURVEY OF DENTAL DIAGNOSIS DURING CHILDHOOD"

By F. BLAINE RHOBOTHAM, D.D.S., F.A.C.D., Chicago, Ill.

In determining the scope and limitations of the field of dental diagnosis related to a specified group, it becomes necessary to make a general survey. With this thought in mind, dental diagnosis during childhood was covered, and a plan was sought to present the findings in a concise form that they might be used for handy reference. The chart "A Survey of Dental Diagnosis During Childhood" was the result. The period covered in this survey begins at the fifth month of fetal life and extends to the fifteenth year.

As a matter of convenience, the entire period is divided into seven age groups, as follows: (1) "fifth to ninth month of fetal life, expectant mother"; (2) "first nine months, breast-fed"; (3) "first nine months, bottle-fed"; (4) "nine months to four years"; (5) "four years to nine years"; (6) "nine years to twelve years"; (7) "twelve years to fifteen years."

Certain diagnostic considerations are peculiar to each of these groups. The grouping, therefore, lends itself to the scheme used in outlining a survey on a condensed chart.

The information suggestive of the items to be considered in diagnosis during childhood is segregated under eight headings: (1) "temperament"; (2) "general health"; (3) "habits"; (4) "diet"; (5) "abnormalities"; (6) "occlusion"; (7) "soft tissues"; (8) "hard tissues."

The chart is laid out in squares. The age groups are placed along the left hand side of the chart, beginning at the top with the youngest group, and listing the seven groups in regular order.

To the right of the age groups, eight squares are provided for the information that would be given under the eight headings as suggested earlier, beginning with "temperament" and concluding with "hard-tissues."

The entire chart should be read through and studied in order to grasp the entire mass of information offered. The chart may then be used as a reference for specific data that may be wanted quickly. The chart is particularly helpful in that its arrangement is such that, by cross-examination, the special items may be readily found.

As an example, should one wish to check up on the diet of a nursing baby, it would be necessary only to read the square opposite the second item on the chart and under the fourth heading. The second item is listed as "first nine months, breast-fed," and the fourth is headed "diet." In like manner, should one wish to find any information regarding a child at any age, it would be necessary only to select the group at the left of the chart which includes the child's age and look under the headings for the information that pertains to that age group.

This chart bears the approval of the American Society for the Promotion of Dentistry for Children. It is printed and distributed by the Bureau of Public Relations, American Dental Association.

The chart is printed on fine, heavy paper in a size (18 by 26 inches) convenient for framing for the dental office. It should serve as a consolidated, ready reference chart for the general practitioner, and as a reminder to patients that children of all ages are given due consideration in the office in which it hangs. It also serves as a simple yet comprehensive means of explaining to parents the amount and type of service that a child at any age may require.

NOTE: Copies of this chart may be secured by writing Bureau of Public Relations, American Dental Association, 212 E. Superior Street, Chicago, Ill., enclosing 15 cents to cover printing and mailing charges.

Prepared by F. Blaine Rhobotham, D.D.S., Chicago
Distributed by the Bureau of Dental Health Education, American Dental Association, 58 E. Washington St., Chicago, Ill
Approved by American Society for the Promotion of Children's Dentistry

LAY DENTAL HEALTH EDUCATION*

By GEORGE H. WANDEL, D.D.S., Riverside, Ill.

NEVER in the history of dentistry has there existed greater need for the education of the public in matters pertaining to the care of the teeth. Conditions of the last few years through which we have passed have been anything but beneficial to the teeth of our people. We have millions of persons out of work. Salaries of workers are greatly decreased. Nutritional conditions, in many areas, have long been dangerously near to or have actually approached inadequacy as far as the general health and mouth health are concerned. Thousands of one-time dental patients are now obtaining little or no dental attention, even though many of them are known to be financially able; and we cannot ignore that vast majority of our population, practically 80 per cent, who have never obtained a semblance of adequate dental service. Millions of children and adults are now carrying potential sources of or actual disease in their mouths. Thousands of dental practices have dwindled almost to the breaking point. Hundreds of new dental graduates are coming into the field to face a situation which must appear anything but encouraging. To all this, we must add the fact that we have lost much ground in those areas where constructive public health educational efforts were being carried on. Several of our state and city departments of health have discontinued their dental activities for economic reasons. Several of the large national health organizations, as well as those who carried on a partial health program, have been forced to greatly curtail their activities.

Assuredly, this does not present a cheerful picture. But there are bright spots of hope and encouragement appearing on the horizon. We are looking forward with a renewed expectancy and a revived hope. We appear to be building a new foundation of economic recovery. If this picture does not prove to be a mirage, our profession may truly look forward to an era of great activity. But we must be on our guard: We must remember that millions of persons have been forced for several years to forego various forms of personal enjoyment that have always proved attractive and, in many instances, are sufficiently alluring to supersede vital and necessary measures for the maintenance of health. The business world is showing itself keenly alert to this situation. Advertising and public education have long been recognized by business as the prime essential to the development of a public demand for merchandise or service. Our profession has long been aware of the influence exerted by "big business" whereby the public purse has been so drained as to make the available funds for medical and dental service almost a mockery. As a profession, we have not done much about this problem in the past. Now, with our backs against the wall, with a new op-

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 10, 1933.

portunity presenting itself, we cannot afford to sit back and make no effort to teach the public the importance of dental health. We don't have to talk about this thing in the privacy of our meeting places for fear we may be misunderstood. It does not require an unusual intellect to appreciate the fact that when a man buys dental service, he gets value received in improved health, appearance and comfort, and, at the same time, he has benefited his dentist financially. That is as fair and square a proposition as any that was ever offered in the business world.

But when we talk of this problem, we must realize that, in our approach to the public, we are in a different position from that of the business world. First, we are a profession which has a background of professional dignity and ethics to maintain. Secondly, we are offering for sale a type of service which deals constantly and intimately with the health and welfare of human beings. Thirdly, while we have the same field in which to cultivate an appreciation of and desire for our service, we are handicapped in our competition with business by a lack of funds, by our professional honesty in the statement of facts and by our lack of what might be termed advertising and sales organizations. In fact, we cannot compare our organization with that of a business concern from the standpoint of public education and sales. Every member of educational and sales divisions of a business concern is constantly carrying out his efforts to sell his company's products to the public, and each advertizing man or salesman is a specialist in his field. If either one fails, he is very soon replaced by someone who can get results. In our organization, it is just the reverse. While we are a national organization with representatives in every section of the country, the product we have to sell is that service which may be furnished by each one of our individual members. That service or product varies with the individual as far as quality is concerned, being dependent on personal knowledge, skill and ambition. The product or service itself and its sale are not hedged about by the stringent rules and requirements of business. We have not placed and we cannot place each of the members of our organization on a schedule of public education and sales quotas required with the understanding that they must get results or get out. Neither are our members trained in the art of public education and selling. Fourthly, in spite of the advances that we have made both in the elimination of pain and in our treatment, diagnostic and restorative procedures, we have not yet succeeded in making and probably never will be able to make, dental health as desirable in the eyes of the public as the theater, the motor car, the radio or the many other attractions with which we are in competition. We have only to look back in history on such health problems as tuberculosis and cancer to fully appreciate that fact. Fifthly, while some may disagree, it is no less a fact that we have failed to assemble vital and important information of a type that would be unassailable and convincing to the public. It is as hopeless to generalize and to make assertions unless the generalizations and assertions are backed up by comparable facts and information. We have only to look back on the experiences of the White House Conference on Child Health and Protection or the Committee on the Costs of Medical Care to appreciate that fact. Here were two activities of the greatest importance to the dental profession, begging for reliable statistics and data on the incidence of dental disease. Many tabulated reports were collected from all over the country, but they could not be used because they lacked the essentials of accuracy, comparableness and scientific as-

semblage. This state of affairs does dentistry no good. It must be corrected if we are to present our cause successfully to the public.

In offering the foregoing facts, it has not been the intention to sound a note of discouragement. Rather, I would have you visualize the situation with which we are faced in this problem of public education, for only then can we go forward. But it is not sufficient that we know our problem: We must act. We must put honest, dignified and constructive effort into our action.

There are many things that can be done to improve our situation. First of all, the dental profession should control its own problem of public education. I have given public utterance to this statement many times. The matter of public education is too much a part of our professional life and controls too surely our professional future and security to allow it to become the property and function of others. Others may aid us, in fact we must seek the aid of other reputable and trustworthy groups, but control must always rest in our hands. There are some who seek the privilege of doing the work for us, and there are some of our members who would give them the opportunity to do it. Past experience has shown that just as soon as we shift the least bit of our responsibility in that respect, we are faced with a problem of control. The outsider does not see the picture as we see it, and he is only too ready to capitalize on the opportunity that has been presented to him. The suggestion has been made that by using an indirect method of approach through lay organizations, advertizing methods or methods of education could be utilized which we as a profession could not well adopt in our direct contact with the public. I would not favor such a plan because of the organizational difficulties it presents and because it presents dangers in control. We have worked hard for many years in an endeavor to free the profession of the publicity methods of the quack and the charlatan. That we are gradually gaining ground in that respect is evidenced by recent legislation enacted in Wisconsin, Oregon and Illinois. This means that our public is coming to an appreciation of our ideals. We cannot afford to undermine that understanding, nor can we afford to place ourselves in the position of planting retroactive ideas in the public mind that would eventually find expression in legislation inimical to all that we have accomplished. Let us keep this thing open and above board at all times. Furthermore, we must appreciate the fact that while wholesale participation or funtioning of an outside group, largely lay in character, might seem highly desirable, especially when originally introduced with protestations of closest cooperation and allegiance, we might eventually be faced with the possibility of a factor of uncontrollable strength which would set out to form its own policies and encourage its own program of legislation. No! We must shape our own course, and we must select our allies carefully, making certain that those allies can never become so strong that they may become our enemies. That the medical profession has learned that lesson only too well is proved by the following statement taken from an editorial in the *Journal of the American Medical Association* under date of Dec. 31, 1932.

> The medical profession . . . has taken an active part in creating organizations, both governmental and voluntary, designed to improve the public health. Then, unfortunately, it has too often allowed these organizations to become alienated from medical guidance and advice. In consequence, some workers in the field of public health have forgotten or overlooked the importance of the medical profession.

The second important need is that of

correlation. During all these years, we have been traveling in many different directions. Methods have been evolved in the various states that differ materially. Even the plans that are in vogue in communities within the boundaries of many states embrace ideas that differ widely. There may be justification to a certain degree for these differences. There is no need to deny that the problem varies from one community and one state to another, but, too frequently, a study of these plans reveals that personal ambition or ego has been the controlling factor. Too frequently, the evidence shows a complete lack of familiarity and analysis of the problems at hand, as well as failure to take advantage of the experience and counsel of others. We have gone along far enough in this situation, wasting time, effort and money, to know that if we ever expect to get anywhere with this problem, we must at once take cognizance of facts, bury ambitions and get down to basic principles. We cannot continue to ignore the fact that there are fundamental principles around which every dental program or activity may be developed. After the fundamentals have been taken care of, we can add the "trimmings," provided they are logical and within our resources, to carry them on without endangering our prime endeavors. With conditions under which we are laboring today, and with the possibility of unthought of and rapid changes in the years just ahead, we must take inventory of our position and then profit by the experience. I am sure that the activity which has been started under the gracious auspices of the United States Public Health Service, whereby a comprehensive survey is being made of dental activities throughout the nation, will go far toward bringing us out of this wilderness of noncorrelation in which we find ourselves today.

Now, let us give consideration to the existing avenues of offense that are open to us in our activities for public education. Under this head, I would list the following: public schools, exhibits, lectures, radio broadcasting, motion pictures, printed materials in pamphlet form, newspaper publicity, cooperation with organizations of various types and the private practitioner. I have not attempted to arrange these various items in the order of their importance. I shall discuss each one of them as briefly as possible.

I will venture to say that no single factor offers the opportunities for success that are apparent in our gigantic network of public and parochial schools. There is no other form of contact, not even in the home, which provides such possibilities of instruction, supervision and the formation of good health habits. The schools are frequently termed "the foundation of the nation." They should and can become the foundation of all dental health teaching. Great strides have been made in this respect in some localities, but before the condition can become universal, much time and effort must be expended to instruct teachers in their training schools and at their institutes. The greatest emphasis should be aimed at this point. It is impossible to teach what is not known. Teachers everywhere are greatly lacking in their knowledge of dental hygiene facts. But we will never get anywhere with this school situation by mere talk. The members of our profession in each state should assume the responsibility within their respective states of convincing the directors of teacher training institutions and of the teachers in the field as to the absolute necessity for the training of teachers and the instruction of pupils in the essentials of dental health. Once that is accomplished, our greatest battle will be won. When it is realized that many of the lessons taught in the

school eventually filter into the home, and that about 31,000,000 children are in school every year, it is not difficult to anticipate what a death dealing blow could be given to this monster of dental neglect, if all school children were given proper oral hygiene instruction from the time they entered kindergarten until they finished high school. This is not an impossibility. I can visualize it as an actuality in a few years from now, if we will but make up our minds to have it so.

In relation to the school phase of our problem, we must not overlook another important link, namely, the nurse. In many localities, the school or public health nurse is the sole health propagandist. Her contacts with teachers and pupils will arouse interest in dental health in direct proportion to her knowledge and appreciation of its importance. A recent report entitled "Hospital Dental Service in the United States" shows that approximately 1,114 hospitals in the United States have some form of dental service. Assuredly, this shows a growing interest in the subject on the part of the medical profession. But what about the nurses in those hopsitals and all the other hospitals? What about the nurses who are taking care of the sick in private homes? How many of them are considering the mouth cleanliness of their patients as an aid toward the more rapid recovery of health? How many of these nurses know how to care for the dental needs of the sick? Certainly not many. Surely these matters are of sufficient importance to merit the sincerest interest and action of our profession. It is a sad but true fact that very few nurses' training institutions give much if any instruction in dental hygiene. No nurse should be permitted to graduate and practice without a substantial knowledge of this one phase of health endeavor. The dental profession in every state should take immediate action to see that at least a minimum of dental instruction is given in their nurses' training schools. With persistency of pressure and offers of cooperation, it should be possible to accomplish much in this direction.

Exhibits of various types dealing with the facts about teeth and their care have not been made use of or given the consideration to which they are entitled in public education. In education there is nothing quite so effective as visualization. By an exhibit, I do not mean a series of placards covered with statistics or uninteresting statements. I mean material that tells its story attractively, conclusively, effectively and in such a manner that the mind can carry the story away as a mental picture. The dental exhibit in the Hall of Science at the Century of Progress Exposition is that sort of exhibit. It is true that such exhibits require ingenuity and the expenditure of money and time for their construction. It is also true that much simpler devices may be employed in the development of an exhibit. I am merely using the exhibit at the exposition as an ideal of showmanship. The fact remains that our Association and its component societies should do more of that sort of thing. There are countless opportunities for the use of this form of public education at county and state fairs, at annual health shows and at all types of lay and professional conventions. In connection with our state and national meetings, we should develop exhibits to which the public would be invited. That has been done at several of our national meetings and one or two of the state meetings. But it should become a constant and growing practice. Our beginning efforts, no doubt, would have to be small, but as time went on we would eventually accumulate many types of meritorious exhibits throughout the country. What a display we could eventually make if our Association and its various com-

ponents, aided by allied organizations, such as the American Academy of Periodontology and the American Society of Orthodontists, would build exhibits that could be shipped to various sections of the country at the time of important meetings or to such events as state fairs.

To the subject of lectures, I shall not devote much space. There is no doubt of the value of lectures or talks to all types of lay audiences. There are some who discourage the idea of having members of the profession presenting talks in the public schools or devoting much effort to bringing the subject of dentistry to other lay audiences. I agree that it has been very difficult in many sections to get the profession interested in doing such work. Misunderstandings, professional jealousy, personal ambition, lack of leadership and other causes are given for the absences of such professional activity in various localities. Any one of these causes is sufficient to impair or completely stop progress along these lines. But it is only necessary to observe the success of some of our professional groups to appreciate the value of the members of the profession bringing the message of dental health to all types of lay audiences. Until suitable facilities are available for teaching in the schools, there will be a need for the profession to carry the message to teachers and pupils. There will never cease to be a time when the profession should appear before lay adult audiences. The sooner the profession in certain areas can awaken to that fact, bury jealousy and develop and encourage leadership in this work, the sooner will the public in their localities show an encouraging evidence of interest.

Radio broadcasting presents one of our most excellent avenues of approach to the public. Through the generosity of broadcasting stations in various sections of the country, the profession has been enabled to broadcast talks from time to time without expense. This is as it should be. But there should be much more of it. Too much of our dental information is being broadcast in connection with the propaganda of commercial products. Furthermore, that information has not always been based on facts. Many leaders feel that some of these commercial broadcasts have been as harmful as they have been beneficial. One thing is certain: The commercial broadcaster has not introduced dental health educational material into his broadcasts because of love for the profession. It is purely a business proposition to him. In a way, you can't blame him for taking advantage of an opportunity as long as the profession will tolerate the situation. Another harmful type of radio broadcasting has been that of the advertising dentist. Because the advertiser pays for his time on the air, owners of stations have refused to give free periods to the ethical profession for broadcasting acceptable information to the public. Broadcasting rates are high and, under such conditions, the ethical profession has been unable to afford to purchase broadcasting periods. That, coupled with the fact that the ethical profession cannot attempt to expose the advertiser over the air without being in danger of a lawsuit, has made it very difficult to offset such efforts with ethical information. There are three ways in which this condition may be overcome. The first is by education. That this does not always prove successful is evidenced by past experiences in Detroit. The owner of the broadcasting station says he must make his station pay dividends. If the advertising dentist offers to pay him for time on the air, the station owner feels that all dental groups should pay him for time, and this in spite of sincere efforts to prove that the broadcasts of the advertising dentist are detrimental to the best interests of the public. On the other

hand, the Chicago Dental Society has been able to convince practically all of the Chicago stations that the advertising dentist should not be permitted to broadcast. The second way in which this condition is sometimes corrected is by offering to purchase the time that is being used by the advertising dentist. While this is usually expensive, it may at least put an end to harmful propaganda in particularly objectionable cases. The third and most effective method of correction is available through legislation. The passage of such legislation will make it impossible for the advertising dentist to exist and will also end his career on the air. But the whole problem of radio broadcasting for purposes of dental enlightenment of the public is dependent on the vigorous and diplomatic action of the profession wherever radio broadcasting stations exist.

I have stated, in connection with my remarks on exhibits, that visualization is probably our best method of public education. There is no visual method that is so popular or effective as the motion picture. Our profession is far behind the times in its utilization of this most excellent method of public appeal. In the first place, nearly all our dental films are designed for use before child audiences. This, of course, is logical, in appreciation of the possibilities that exist in child education, but it has been carried almost to the point of complete neglect of the adult. Wouldn't it be wonderful if we could develop films for adult audiences that would enlighten them in such matters as nutrition, home care of the mouth, pyorrhea, malocclusion, caries, dental infection, the roentgen rays, restorative dentistry and other important subjects? In addition, we could develop the most modern types of films, under the guidance of recognized educators, for use in our public schools. In the case of the silent film, the time is not far distant when it will be almost entirely replaced by some form of sound film. That has already occurred in the theater. It is going to be necessary for us to keep that fact in mind. Already we hear complaints from some localities that the sound film has not been so developed in dentistry that local theater facilities could be utilized. The fact has been called to our attention in several instances that local movie theaters would be glad to show dental educational films to their audiences if they could secure up-to-date sound films. In that connection, dentistry's most active producer of dental health educational films, Thomas B. McCrum, of Kansas City, has suggested that small strips of film could be developed on interesting dental topics, using the off-stage voice arrangement that is used in the news reels, presented by Graham McNamee. He believes that such film strips would prove attractive to movie theater owners, and I am inclined to agree with him. If such a development could be brought about, dental health messages could be brought to millions of people who are not readily reached in any other way. And this would aid materially in offsetting the effects of certain comedy films which place the dentist in a ridiculous and sometimes uncomplimentary light. There is no doubt in my mind that the many avenues offered through the use of motion pictures must be developed by dentistry if it is to keep step with the times and with the methods of other health groups.

All methods that have to do with word of mouth and visual presentation of educational material are excellent. But they must be developed further and supplemented by printed material. The public forgets too readily, and it does not always grasp all that is offered to it in the way of information. It is not uncommon to hear people remark, after they have seen an exhibit or a motion picture or listened

to a talk, "That was fine, but I wish I had that information in printed form so that I could study it more thoroughly and put the suggestions into practice." New and modern pamphlets should be prepared for distribution to the public. They should be developed to offer vital information of value to the child and the adult. There should be one pamphlet containing general information, and others that treat individually of special topics such as nutrition, pyorrhea, artificial dentures, malocclusion and tooth brushing methods. These pamphlets could be distributed in dental offces and through all manner of health organizations. They would be of inestimable value in the hands of the school teacher, the hygienist, the physician and the nurse. In spite of its great value, we have not begun to make use of the printed sheet to the extent that we should. Something must be done to take every advantage of the opportunities that are offered by this method of public enlightenment.

There is another form of printed matter which offers great possibilities. Today, the newspaper is undoubtedly our strongest arm in public education, especially for the adult. If our profession could gain the cooperation of the newspapers of the country, there is no doubt of the good they could exert in aiding us to overcome the great scourge of dental disease. Already, they are giving many columns of their papers each year to the advancement of other phases of public health. They have even gone so far as to pay certain medical writers to contribute regular articles pertaining to health. It has been a mystery to me why some newspaper editors should do all this for the medical profession and at the same time insist that the dental profession pay for publication of its educational material. There is no other human ailment that is so nearly universal as dental disease. It is true that some of these editors, at some time or other, have had to pay out goodly sums for dental attention. But the service they obtained was as truly a health service as any that could be rendered by the physician or surgeon. Possibly, we have not sold dentistry as a health service in our practices. Possibly we have sold only crowns, or bridges, or dentures or extraction service. Possibly our whole professional attitude toward and contact with the public needs revamping. Perhaps we have been at fault in allowing the newspaper man to obtain a wrong impression of our profession and the service it is rendering and can render to humanity. It might be well for us to take honest stock of ourselves and see if we aren't partially or wholly to blame in this matter. But whatever the situation, the newspaper can aid us materially.

I must not fail to mention the possibilities that exist in feature articles that might be developed and published in leading magazines. The history of dentistry's growth and development contains many feature stories that would command the interest of magazine readers. Outside the methods used in radio in reacting important historical events, the feature article in a magazine offers the best field in which to develop a wholesome respect for the struggles of our profession to bring dental health and comfort to mankind. But whatever form our publicity takes, one point is paramount: If we are to go into a program of publicity, we should determine as definitely as possible, for the guidance of our members, those methods which are not in keeping with our general conception of ethics and professional dignity. I feel positive that the establishment of these boundaries of activity are of the greatest importance. Groups of our profession all over the country are waiting for just such direction. It may require additional definition in our code of

ethics, but without some code or pattern to follow, we shall be constantly faced with the problem of passing judgment. Such a condition would be productive only of friction and dissension. It should be possible, in a democratic organization such as ours, to devise such a code or "gentlemen's agreement" that little or no difficulty would be experienced in carrying on a constructive program.

There are several other phases of the publicity question which I wish that I could discuss at this time, but because of official consideration that is being given to the subject, it would not be in good taste for me to do so.

I have stated on a number of occasions that it is good public health doctrine to utilize existing machinery whenever possible. There are numerous health organizations in the country at the present time, including state and local departments of health. Our relationship with these groups justifies a maximum of cultivation. With their whole-hearted cooperation and support, we can travel much farther and faster in our educational efforts. Some progress has already been made, but we have only scratched the surface.

And now I come to private practice and the education of the patient at the chair. I have seen too much evidence in the past ten years to believe that we as individuals have been taking sufficient advantage of our opportunities to enlighten the patients that we already have coming to our offices. In my contacts with lay people in various sections of the country, I find the common complaint, "My dentist never tells me anything about the care of my teeth," or "My dentist doesn't like to work for children." Such professional conduct is surely not in keeping with the ideals of our profession. Our patients do not come to our offices because they know all there is to know about the care of their teeth. Their presence there is more likely to reveal a "need" for knowledge than an "existence" of knowledge. And how can we continue to make our public believe us if we continue to neglect our child patients? If we go into the schools, or the public meeting, or the press, or on the air with our messages of prevention and early care, and then don't live up to them in our daily practice, there can be only one reaction and that will be negative. Without a large majority of our profession showing real interest in the education of the patient at the chair, and without a willingness to work for children and do that work well, we shall be wasting much of our educational effort outside.

There are other important educational features that might be discussed, such as clinics, research, field study of existing programs, the necessity for balance and standardization in our health program activities and professional education, but time does not permit. There is one matter to which we must give consideration, and that is finance.

It is a self-evident fact that the various suggestions that I have outlined for public education must have financial support to carry them through. It is also evident that these developments would have to be gradual. It would be financially impossible to put all of these vehicles of education into immediate use. But we could at least get a start. One thing is sure: Our Association funds are not of sufficient magnitude to do very much. We must look for financial support in other directions.

In the past, offers of funds have been made by outside organizations, such as the manufacturers of various dental products. About a year ago, funds were accepted from the American Dental Trade Association for a publicity program. It has recently come to my attention that

financial support from other sources is not improbable, if the Association could see fit to accept. But there is a well based fear that, in the acceptance of all such funds, the Association would be misjudged by the public or would be placed in a compromising position by the donors. In order that these objections might be overcome, Mr. L. T. Claridge, the Association's business manager, has submitted a suggestion that has much merit: The various dental manufacturers, dealers and manufacturers of products acceptable to the Council on Dental Therapeutics might increase their advertising in THE JOURNAL with the understanding that 50 per cent of their increase in JOURNAL advertising over their present advertising allotment to THE JOURNAL would be turned back to THE JOURNAL to cover costs, and the remaining percentage would go into a fund for public education. In order to picture how this would work out, the following explanation is offered: A minimum advertising revenue would be set aside and not included in the amount to be considered when determining funds available for educational work. This minimum revenue would be, we will say, $50,000. This amount would represent the expected revenue if this proposed plan was not operating. Then, all the excess of advertising revenue over the above-mentioned amount would be split, 50 per cent going to THE JOURNAL and 50 per cent to the educational fund. If we assume that THE JOURNAL advertising revenue was increased on this basis from the minimum of $50,000 to $75,000, the following distribution would be made: The minimum amount of $50,000 required for THE JOURNAL would first be subtracted, leaving a balance of $25,000. This last amount would then be split as previously explained, 50 per cent, or $12,500, going to THE JOURNAL to cover costs, etc., and 50 per cent, or $12,500, going to the educational fund. Such a plan, it seems to me, is fair. The prospective donors to our Association educational activities would be getting double returns on their investment, because they would profit directly from the advertising space in THE JOURNAL and indirectly from influence exerted on the public through our educational endeavors. Our Association would benefit because of increased advertising revenue and additional funds for public education. In addition, any stigma attached to the acceptance of donations would be swept away. I believe this idea has merit.

As an alternative to the above-mentioned idea, we might be able to work out a plan for a central fund into which donors could place various amounts, giving the Association absolutely free rein to use the money as it saw fit. This does not seem to me to be impossible of arrangement, judging from statements to which I have listened in the last few months.

Another source of funds would be the profession itself. I realize that many of our members have suffered great financial reverses and that every penny, for some of them, must go to care for office and living expenses. I am reluctant to suggest that the profession make any further sacrifices. But in looking for funds to carry on this work, we must appreciate the fact that, while the public will benefit from increased knowledge and improved health conditions following any educational program that we might carry on, the profession will also derive benefit. It would require only a minor contribution from each member to make a sizable sum. There are many business concerns today that have suffered great inroads on their finances, but they are making still greater sacrifices in order that the public may be influenced to purchase their services or

products. Possibly the dental profession should look at the situation in the same light. I realize that a plan of voluntary professional contribution might conflict with the workings of the Dental Relief Fund program. Possibly, direct contributions from each state society might be made to a central fund for educational purposes. But whatever the plan, it does seem that the profession is going to have to find a means of greater financial support.

CONCLUSION

I must leave one additional thought with you. There is no doubt of the need for public education. We know that a very small proportion of our population has been obtaining dental service. Possibly, someday, a larger section of our people can be made sufficiently appreciative of mouth health to obtain it at the sacrifice of some of their pleasures and so-called luxuries. But there will still be a large number of people who are financially unable to purchase adequate dental service. By our educational activities, we will be creating a demand for dental service. Someday it is quite likely the demand will catch up with our program of education. How are we going to meet it? We are not going to be able to go on forever ignoring that situation. We will have to solve the problem, and the sooner the better. The low-wage earners make up the greater proportion of our population. They may continue to overlook their inability to own homes or to enjoy some of the pleasures of the people in the higher-wage brackets, but when it comes to health and the services required to preserve it, they are not going to overlook that many years longer, especially if we continue to emphasize its importance. This is a vital question and must not be ignored in the consideration of any program of public dental health education.

There is no doubt that the time is more than ripe to do something. The time is past when only a few persons should shoulder the burden in this great problem of public education. The situation is staring us in the face and awaiting solution. We must get busy. We may have to change some of our long cherished ideas to bring action out of our present state of inaction. If we must sacrifice, let us do so wisely. If we are to go anywhere, let us go there together, as one unit, and make sure that we arrive.

MAKE USE OF YOUR SLIDE SERVICE

Educating the public to appreciate dental health is a gigantic and often discouraging task.

The Bureau of Public Relations was created to assist in the accomplishment of this task. We need your cooperation. You can educate your community far better than can someone in the Central Office a thousand miles or more away.

You are part owner of 1,600 stereopticon slides. Lying unused in the Central Office, they are a liability. You can make them an asset. With them, you can help humanity, improve health, spread knowledge, aid the profession and serve yourself —because we serve ourselves only as we serve others.

Write for your slide list. It contains descriptions and rental fee. Select your slides. Use them in your community health service. Make use of your knowledge, a knowledge intended for service, nót to be merely an ornament.

NEWS

CALIFORNIA

Chinese Dental Activities: As an outgrowth of the dental examination of the children in the public and parochial schools conducted last October by the San Francisco District Dental Society and the San Francisco Department of Public Health, six Chinese dentists have devoted their time to the examination of 239 Chinese children at the Commodore Stockton School. As an outgrowth of this activity and the realization of the need of dental care among their own people, this group endorsed a petition to the Chinese Parlor of the Native Sons to establish a dental clinic for destitute Chinese children. They also pledged themselves to aid in any way the promotion of dental hygiene among their people, by means of clubs, associations and groups, and finally organized themselves into a Chinese dental society in order to define more clearly and carry out their aims and purposes.

CONNECTICUT

Fauchard Medal Award: The Fauchard Medal, awarded each year by *Dental Survey* to the person whose contribution to preventive dentistry has been particularly outstanding, was this year presented to Alfred C. Fones of Bridgeport. Dr. Fones is considered the father of the dental hygienist movement. He was the first dentist to employ a woman dental hygienist, and was instrumental in establishing the first public school clinics in Bridgeport, which so far as known were the first of their kind in this country.

HAWAII

Alumni Organize: Just prior to the 1933 alumni meeting word was received that a branch of the alumni association of the College of Physicians and Surgeons of San Francisco, a College of Dentistry, had been organized in Honolulu with the following members: William S. Ling, '22; Anthony Gonsalves, '20; Dr. F. R. Silva, '27; Yshimatsu Nakata, '18; Arthur F. Luhr, '33; Y. O. Mark, '25, and N. B. Borja, '27.

The members of the Hawaiian Branch desirous of being of assistance to the college in promoting dental education, pledged themselves "to encourage the study of the technic and development of ability in prosthesis."

ILLINOIS

Delinquent Member Penalty Waived: Recent unanimous consent by the Executive Council of the Illinois State Dental Society makes it possible for the delinquent member to be reinstated in the society by payment of 1934 dues only, without the penalty of one year's back dues. This waiver of the penalty is good only until March 1, 1934, at which time the penalty will again be effective. In the opinion of the council, economic conditions seem to justify this gesture to those who, in good faith, have become delinquent for this reason alone. By permitting these men to reestablish themselves in membership, with the consent of their component society, the officers feel that many deserving men will be returned to the dental society fold and that both the society and the man will be benefited. It is to be hoped that 1934 will mark the beginning of better times for men and their families who, through no fault of their own, have had to sit idly by and watch their income and investments shrink and disappear. Those men the state society evidences a sincere desire to aid.

Banquet to Dr. Gallie: Don M. Gallie, teacher of operative dentistry in the University of Illinois College of Dentistry, will be honored, February 24, by a banquet given in recognition of his long years of service in the dental profession.

INDIANA

Dedication of New Indiana University Dental School Building: It has been determined that the formal dedication of the new Dental Building will be held in conjunction with the annual meeting of the Indianapolis Dental Society in January. The Indiana University School of Dentistry Alumni Association will have charge of the program. C. N. Johnson will be the principal speaker and the attendance of many notable figures of the profession is expected. Full information concerning this meeting will be issued as plans are completed.

Announcement from Indiana University School of Dentistry: In order to provide op-

portunity for graduate study to all of its alumni and all other dentists, graduates of other schools, practicing in Indiana, Indiana University School of Dentistry offers its clinics, laboratories and all other facilities to those who may desire to improve themselves in any department, free of any charge, during the school year. This offer includes the work in diagnosis, gold foil, amalgam, ceramics, crowns and bridgework, roentgenology, prosthetics, exodontia and surgery, anesthesia and pharmacology, root canal procedure, periodontia, orthodontia. Those who wish to avail themselves of this offer are asked to write the secretary, G. D. Timmons, for full information.

MARYLAND

Organization of a Baltimore Section of the International Association for Dental Research: In July, 1933, the organization of a Baltimore section of the International Association for Dental Research was effected. The present members are: E. V. McCollum and A. Schultz, both of Johns Hopkins University, and E. Dobbs and M. Aisenberg, both of the Baltimore College of Dental Surgery. In the near future, the Baltimore section will announce its program of activities.

Dental Service Arranged in the University of Maryland Hospital: Arrangements have been made by the School of Dentistry, School of Medicine and Hospital at the University of Maryland for a dental service in the hospital. Such service will be provided by members of the teaching staff in the School of Dentistry and a limited number of dentists. The dental service will afford consultation for patients referred from other hospital services. Treatment of all surgical cases will be provided by a staff composed of medical and dental members. Robert P. Bay, professor of oral surgery in the dental school, who was recently appointed professor of oral surgery in the University Medical School, will direct the surgery clinic. Horace M. Davis will direct the dental service and A. C. Cook, of the class of 1933, University of Maryland, will act as the dental interne in hospital.

MICHIGAN

Detroit Dental Bulletin: Under the caption *The Detroit Dental Bulletin,* an attractive new dental publication made its appearance in October. It is to be published monthly by the Detroit District Dental Society and is to be of a strictly bulletin type. The editor is Walter C. McBride.

Dental Conferences: The Council of the Michigan State Dental Society and the District Officers met in conference at the dental school building of the University of Michigan, College of Dentistry, in Ann Arbor, November 17, at 2 p. m., the president, Ward Moore, presiding. Mr. J. E. Cummins, from the state board of tax administration talked on "The Michigan Sales Tax and How It Affects the Dental Profession." D. B. Newton and Don E. Moe presented a paper on "Some Present Day Problems Confronting District Dental Society Officers," and M. Webster Prince read a paper on "What Has Membership in Organized Dentistry to Offer the Dentist?"

The faculty of the University of Michigan, College of Dentistry, the Michigan State Board of Dentistry, Michigan State Dental Society and district officers met at a dinner, November 17, at the Michigan Union, Ann Arbor, Dean M. L. Ward presiding. Dr. Ward spoke on "Problems in Dental Education." James L. Spencer spoke on "Problems in Law Enforcement," and U. G. Rickert read a paper entitled "A Challenge to the Dental Profession."

NEBRASKA

School Given "A" Rating: G. A. Grubb, dean of the Dental School of Nebraska State University, announces that the school has been awarded a class "A" rating.

NEW JERSEY

Elected to College of Dentists: Two more Hudson County men, Charles Faupel and Louis Brach, have been elected to fellowship in the American College of Dentists.

Indigent Service Projects: The Council, realizing that the dental societies should provide dental facilities for indigents, is planning to assist local societies in this respect. M. E. de Monseigle, Electric Bldg., Asbury Park, N. J., has consented to supervise this phase of the Council activities.

OHIO

Ohio State Dental Society Meeting: The Ohio State Dental Society held its sixty-eighth annual meeting at the Neil House, Columbus Ohio, December 4-6. Among the speakers on the program were: Surgeon General Cumming; A. C. Wherry, C. E. Rudolph, C. T. Messner, C. O. Simpson, W. A. Price, G. C. Paffenbarger, H. W. MacMillan and Howard C. Miller.

OKLAHOMA

Dr. Lawrence Honored: C. R. Lawrence was awarded an honorary degree and fellow-

ship in the American College of Dentists during the recent meeting of that organization in Chicago. Dr. Lawrence is a member of the Executive Council of the Oklahoma State Dental Society, and the Board of Trustees of the American Dental Association.

Orthodontists Form Society: The exclusive practitioners of orthodontia in Oklahoma have organized a society the object of which is to advance the art and science of orthodontia by: encouraging the fraternal relationship among its members, promoting research in those fields related to it, striving for higher standards of excellence in orthodontia teaching and practice and contributing its part to the general scheme of health service.

OREGON

Dental Act Upheld Again: For the second time in two consecutive months, the validity of the amendments to the dental practice act have been upheld by the courts. Judge Hall Lusk of the Multnomah County Circuit Court handed down an opinion in the case of Semley vs. the Board of Examiners on the seventeenth of last month in which the demurrer of the board was sustained in every particular. A similar opinion was given in September by Judge Norton in Lane County in the case of Donohue vs. the Board.

The Portland Plan of Dental Education: For over two years, the Portland District Dental Society has tried various methods of educating the public in dental health matters, including the use of radio, newspaper, addresses to educational groups, and the concentration of effort during "Mouth Health" week. It was discovered that the profession and the public needed and desired "edited material" to tell the story of health best. As a result twelve readable, inexpensive and acceptable pamphlets on different dental health subjects were carefully prepared. These pamphlets have become very popular. Requests for them have been so great that the Portland Society had to form a special organization to supply the demand from dentists, societies, and so forth. The titles of the pamphlets are: "Dentistry as a Modern Health Service," "Growth and Development," "Anesthesia," "Children's Dentistry," "Orthodontia," "Pyorrhea," "Diet and Good Teeth," "Preventive Dentistry," "Oral Surgery," and "Mouth Infection." The Portland Dental Society Educational Plan is based on a membership of 100 dentists. Each member pays $12 a year, $1 a month. For this sum, each receives 1,200 pamphlets (100 a month). Also, the societies making use of this plan receive 20,000 additional pamphlets as well as thirty-six radio talks, thirty-six newspaper articles and the plan of operation, free of charge. In short, a total of 140,000 (pamphlets) messages on the necessity for dental care and the value of dental health is made available to every society having 100 members for $12 a member. In smaller groups, the price is a little more if the name of the society is printed on the pamphlets. If stock pamphlets are used with only the title on the first page, the price is the same. Portland is justly pleased with its accomplishment in promoting interest in dental education. M. A. Milne, Medical Arts Bldg., Portland, is in charge of this service.

TEXAS

Dr. Brady Appointed to State Board: Governor Ferguson has appointed J. B. Brady, of El Paso, a member of the Texas State Board of Health. Dr. Brady has been a member of the Texas State Board of Dental Examiners, alderman of the City of El Paso, and a member of the Civil Service Commission of El Paso, which office he still holds. It was largely due to his efforts that the first school dental clinic, supported by public funds, was established in El Paso.

State Bulletin Conveyed to State Society: At the request of the A. P. Cary Company, publishers, the Texas State Dental Society has accepted as a gift, all right, title and interest in the state dental journal. In accordance with instructions from the house of delegates, the president, Dr. Delafield appointed a journal committee to publish this, the official organ of the society. The editor, J. G. Fife, sent his resignation to the committee, and at the first meeting, held to select an editor-manager, the position was offered Dr. Fife in recognition of his eminent qualifications and vast experience. On his request to be relieved of the editorial duties, William Ogle was made editor-manager.

Dentist Secretary of Board of Health: L. E. Stark, El Paso, has been recently appointed secretary of the Board of Health of the City and County of El Paso. The city and county health departments have been combined under the supervision of T. J. McCamant, health officer. The combination of these departments has resulted in a substantial reduction in the budget and a more efficient operation of the public health service. W. J. Reynolds is employed as part time dentist to care for indigent school children. There is a corps of fifteen nurses employed by the department whose

duties include the reporting and referring of dental cases found in the schools.

WASHINGTON

Dr. Wight Appointed to Health Board: H. E. Wight, of Yakima, past president of the Washington State Dental Association, has been named a member of the state board of health, according to an announcement of Gov. Clarence D. Martin. Dr. Wight is believed to be the first dentist ever appointed to the board.

WISCONSIN

Wisconsin Passes Dental Law: Wisconsin was successful in passing a new dental law in 1933. The Board of Dental Examiners has been restrained from enforcing many of its provisions owing to two injunctions filed by advertising dental interests in Milwaukee. In one case, the constitutionality of the law is attacked and in the other the attack is directed toward the rules and regulations set up by the board. Arguments have been heard in both cases and the judge's decision is awaited.

Dental Health Survey: Wisconsin members are supporting the dental health survey and the work of making examination is getting under way. This survey is creating interest among the nonmember dentists of the state. One or two component groups have entered into agreements with the local directors of relief under "Rules and Regulations, No. 7, Governing Medical Care Provided in the Home to Recipients of Unemployment Relief" as released by the Federal Emergency Relief Administration. Because of the importance of this activity and its effect on the dental profession, it has been deemed advisable to prepare a special bulletin giving extracts from these rules and regulations, and these have been mailed to component groups for study.

Honorary Degree to State President: August 6, at the joint meeting of the American Dental Association and the Chicago Centennial Dental Congress, Hotel Stevens, Chicago, R. W. Huegel, president of the Wisconsin State Dental Society and past-president of the Dane County Dental Society, was granted the Honorary Degree of Fellow of the American College of Dentists.

GENERAL

American Dental Hygienists Association Officers: Officers and trustees of the American Dental Hygienists' Association, Inc. are: president: A. Rebekah Fish, Washington, D. C.; president elect: Addibel Forrester, Atlanta, Ga.; vice presidents: Frances Shook, Detroit, Mich.; Myrtle Jamison, Minneapolis, Minn.; Margaret Bailey, Philadelphia, Pa.; board of trustees: Evelyn M. Gunnarson, New York City; Celia Perry, Miami, Fla.; Gladys Shaeffer Myers, Lancaster, Pa.; Helen Baukin, Honolulu, T. H.; Helen Blake Smith, Stratford, Conn.; Lauretta E. Parkinson, Wilmington, Del.; secretary: Agnes G. Morris, Bridgeport, Conn.; treasurer: Cora L. Ueland, Los Angeles, Calif.; editor: Margaret H. Jeffreys, Crafton, Pa.

Value of Dental Instruments: The Bureau of the Census has made a special compilation of reports submitted on classification of "instruments, professional and scientific, and gages, except machinists' gages." This report shows that dental instruments produced in the United States during 1931 were valued at $1,099,797 as compared with $2,224,829 for 1929 (shipments or deliveries by manufacturers).

FOREIGN

Increase in Number of Dentists Attached to Public Schools in Japan: The school dental law was promulgated in 1931, and the school dental service regulations were announced by the educational office of 1932. Complete control all over the country in this line of hygiene has been made. In spite of the business depression, the employment of school dentists has rapidly increased. According to an investigation in April, 3,619 primary schools had employed 2,788 dentists. Last year, 126,699 yen was spent in the primary schools and 14,965 yen in the middle grade schools for this purpose.

CURRENT LITERATURE

Agranulocytosis in Childhood (T. B. Givan and B. Shapiro, Am. J. Dis. Child., September, 1933): Schultz, who first described agranulocytosis in 1922, did not admit the occurrence of this disease in childhood although some cases had been recorded previous to his report. Givan and Shapiro report twenty-nine cases, the youngest patients being infants 10 weeks and 12 weeks of age, respectively. In the cases presented, neither sex showed a predominance. With four exceptions, all the patients had definite histories of immediate antecedent acute infections leading up to the period of agranulocytosis. Anemia was a pronounced factor in all the cases with one exception. There was a too marked reduction of red cells with agranulocytosis and leukopenia. Nine patients had septicemia. Recovered organisms were not constant, although *Staphylococcus aureus-hemolyticus* predominated. Lesions were not constant, but when present were in the buccal region, varying from plaques on the tonsils to ulcerative gangrenous processes of the pharynx. The duration varied from four days to two months. Necropsy showed involvement of bone marrow granular cell centers. Nucleotide therapy was employed. Transfusions were interdicted because of their depression of the bone marrow. Adenine sulphate 0.3 gm. in physiologic solution of sodium chloride was given. When the bone marrow produced white cells to their indicated level, adenine sulphate was discontinued and small transfusions of 120 c.c. were administed daily for ten days. All but one patient died. The cause of the condition is not known. The most probable hypotheses are: The condition is a specific disease entity. It is a granuloleukopoietic disease of the bone marrow. Some specific selective toxic action on the marrow is present. The condition is due to an infection superimposed on a preexisting hypoplasia of the granulopoietic apparatus. It is a malignant leukopenia of a leukemic nature. The condition is secondary to an endocrine dyscrasia. It is an atypical form of sepsis.

T.

Present Status of Ethylene (Isabelle C. Herb, J. A. M. A., Nov. 25, 1933): Herb sent out 1,000 questionnaires to authorities on the status of ethylene in the United States, Canada and foreign countries, 534 answers being received. Of those addressed, 220 were using ethylene; 314 were not. Ethylene alone was administered about 737,815 times, with ether 267,560 times, a total of 1,005,375 anesthesias. No explosions nor deaths were recorded. The odor of ethylene is due to impurities. Since the manufacturers have eliminated these, patients seldom refer to or object to the odor. It is not unpleasant if administered slowly with oxygen during the induction of anesthesia. Nitrous oxide is not administered with ethylene at the Presbyterian Hospital of Chicago as ethylene is not unpleasant alone and the two gases might not be injurious to the patient's lungs. After extensive experience with chloroform, ether and nitrous oxide-oxygen, Herb believes that ethylene has distinct advantages over all of them. It has an advantage over nitrous oxide as it produces greater relaxation, and better oxygenation can be maintained throughout long operations. The safety of gas anesthesia is due to the percentage of oxygen that can be given with it. Cyanosis does not develop with properly administered ethylene; which shows that blood changes are practically absent. Luckhart's results relative to blood changes have been repeatedly confirmed by other workers. Ethylene has made large inroads on the use of ether. Sometimes both may be used, the ethylene to shorten the time ether is employed. Ethylene does not stop peristalsis as ether does; which is sometimes desirable. The widespread publicity given early mishaps accounts for the fears of explosion when ethylene is used. Dentists expressed a preference for nitrous oxide because of fear of explosions and because it is pleasant to inhale. Those who use ethylene praise it especially for jaw operations and impacted teeth. Herb says that publicity given the explosion hazard is unfortunate, as it deprives patients, surgeons and anesthetists of a valuable agent. Bevan, in an abstract of the discussion, says: "I think Dr. Luckhart and Dr. Herb have made the greatest contribution to anesthesia that has been made in the last twenty years.

T.

Prophylaxis of Hemorrhage (F. E. Harding and F. G. Clark, Clin. Med. & Surg., September, 1933): Many products said to be of value in promoting blood clotting are on the market. Of these, parathyroid (for hypodermic use) and glucocalcium or calcium gluconate (for intravenous therapy) seem to give the best results, but the latter is more difficult to administer and more unpleasant for the patient. Tablets of calcium, parathyroid and other preparations for oral use are more uncertain in their effects owing to changes effected by digestive juices and the variability of their absorption. The rationale back of parathyroid therapy has been definitely proved by Callip. The calcium is mobilized in the blood stream and this biologic reaction is so specific that it is used in standardizing the hormone. The procedure is considered safe as no hypercalcemia developed in any of fifty cases. But results are obtained by a daily injection for five days, with operation on the last day, if the bleeding and clotting times are satisfactory. An injection twenty-four hours before and on the morning of the operation may be beneficial as a hemorrhage prophylaxis in normal persons. T.

Unusual Case of Multiple Epulides of Medullary Type (E. K. Tratman, Brit. D. J., Nov. 1, 1933): A male Bengali who had lived in Malaya twenty-seven years gave a history of two months' bleeding from the gums and growths of the jaws. Examination of his mouth revealed that the whole surface of the mandible back to the rami and the whole of the surface of the maxilla were completely covered. The hard palate and a portion of the soft palate were covered. The only teeth present were the upper right first bicuspid and third molar and the lower right central incisor and second and third molars and the left third molar, all of which were very loose. They had been moved from their normal positions by the growth. The patient's condition was bad, there being a marked cachexia. Operation was performed and death occurred two days later. The actual causes of death were certified as visceral syphilis and secondary anemia. Microscopic examination showed epithelium with well-formed basal cells, but poorly defined surface cells. Underneath the epithelium was a layer of granulation-like tissue. Hemorrhages were present in several areas. Giant cells were entirely absent. A long history of paradental disease is common to these people. Literature on the subject as it concerns Malaya is scanty. T.

Foreign Literature

Clinical Study of Sinusodental Communications (Pierre Krivine, Semaine Dent., September, 1933): After the extraction of upper bicuspids and molars, one is struck by the frequency of communication between the alveoli and the maxillary sinuses. The author found, in his personal practice (March, 1929-August, 1932), thirty-six cases of sinusodental communication out of a total of 875 extractions of upper bicuspids and molars. These communications are of two different types clinically and pathologically. The classic reaction is acute or chronic sinusitis due to more or less immediate contact with the infected dental root. Of the author's cases, only twelve were of this type. The remaining twenty-four gave no sinus reaction. The communication in this case was by a paradental cyst. Systemic examination of the alveoli after extraction reveals these cases. The author discovered that, in observations with torpid cysts, injections of water into the alveolus came out through the nose. If the mucous membrane only had been compressed by the cystic pocket, this nasal communication did not exist. He states that after the extraction of the offending root and the opening of the cystic pocket, he never discovered any draining of the cystic fluid. He shows how slowly the fistulization takes place without bringing about a sinusal reaction, and the liquid absorbs. He compares its action with fistulas with vestibular outlet. The author divides his observations into three categories. In the first fall the cases with acute sinusitis; in the second, the latest forms, and in the third, forms with sinusal reactions with deceiving manifestations which lead to diagnostic errors. He proceeds to give the symptomatology of the three categories. In the first, the patients are usually young people, and there is violent pain, with fever and swelling. The offending tooth in these cases is usually the second molar. Roentgen-ray pictures should be taken to aid in determining the vitality of the tooth, which should be extracted, and the sinuses washed out. He describes the operative procedure, laying stress on the care which should be taken if there is any maxillary osteitis present. The second category of cases usually take place in older people. Usually, neither patient nor doctor suspects its presence. It may be discovered when the mouth is being prepared for a new appliance. Careful examination should be made to discover cysts communicating with the sinuses and they should be curetted. If cystic sinusal injection is produced, one has

the third category with its diagnostic difficulties. The sinusal reactions may be acute, nonexistent or latent. When neuralgia and radiating pains appear with pulpless bicuspid or molar teeth, the dentist should suspect sinus reaction. If the tooth has been extracted, it may be that a granuloma has been left in contact with the sinus causing an osteitis of the floor of the sinus. These cases are difficult to diagnose. The author suggests other possible combinations which may occur in this category, as well as the subsequent therapeutic procedure: extraction of the offending teeth, washing of the sinus and curettement of any diseased bone present. Frequently, radical procedure in the sinus is not necessary, if the dentist discovers the offending tooth. If the sinusitis is of recent origin, it will heal completely if the infected agent is removed. If it is of long standing, the same method must be used, but the desired result will be longer in coming about because of the extent of sinusal involvement. The author gives representative case reports and makes clinical deductions from them. T.

What Dentistry Owes to Roentgenography (A. Boulard, Semaine Dent., Oct. 15, 1933): All phases of dentistry have made rapid strides since the beginning of the century. There are many reasons for this, the greatest being the general development of science, instruction, and education of the public, the increase of savants and of business men. Probably one of the most outstanding contributions is the discovery of Roentgen. Until the war, there was much pioneering in this field, and just before the war, the first attempts were made to utilize the Roentgen apparatus in dentistry. Since then, its contribution to dentistry has been great. Roentgenology has supplemented embryology, osteology and descriptive anatomy in the study of the pathology of the mouth. In dental surgery, it has suppressed the blind search for causes of fistulas, suppuration and inflammation, showing the locations of structures and foreign bodies. It has promoted rapid decision and enhanced the possibility of conservation of teeth. It leads to early diagnosis of dental conditions. Its rôle in prosthetic dentistry has been invaluable. It helps the pedodontist to determine the developmental stage of teeth, warning of abnormalities and preventable lesions. In dental orthopedics, it serves as a constant guide. It alone often aids in the diagnosis of multiple diseases of the jaws, and in the etiologic explanation of such troubles as sinusitis, neuralgia and the presence of salivary calculus. Its revelations must be properly interpreted. It will play an important rôle in the prophylactic dentistry of the future. T.

Influence of Maternal Nutrition on Development of the Fetus (P. Jones, Arch. f. Kinderh., Dec. 13, 1932): In a previous publication, Jones reported his experiments in which starvation of pregnant dogs uniformly resulted in absorption or extrusion of the fetus before the maternal supply of glycogen and fat was entirely consumed and showed that the administration of food to the mother after pregnancy had been terminated would maintain her life. These observations contradict the widespread belief that if the maternal diet is inadequate, the fetus will withdraw its required nutritional materials from the mother's own body reserves until they are completely depleted. Jones argued that his results agreed with wartime statistics, which revealed that undernourished women gave birth to small infants and showed a higher incidence of abortion, miscarriage and premature labors than the well-nourished women of other periods. T.

Leukoplakia Buccalis (Von Rille, München. Med. Wchnschr, 1933, p. 26): The author describes two types of the disease: 1. Leukoplakia simplex, caused by pressure of the teeth on the cheek. The chemical causative agents are: tobacco and alcohol used in excess. In mild cases, cloudiness of the epithelium and a bluish whiteness and tenderness of the mucous membrane are observed. In more advanced cases, there occurs a whitish thickening of the membranes, which may become fissured and segmented, and giving rise to bleeding and painful crack formation. The gum ridge may become obliterated. 2. Syphilitic leukoplakia, occurring most frequently on the lower lip and on the free margin and lower surface of the tongue. After the tertiary stage of syphilis, glossitis indurativa, a most intensive lesion of the tongue, is commonly met with. Carcinoma may develop from both forms of leukoplakia, but most commonly from the syphilitic type. The treatment consists of painstaking cleanliness of the oral cavity and teeth, application of a caustic pencil to the fissures and cracks, packing of the tongue with iodoform gauze or iodoform spray (which is very painful and uncomfortable). Rinsing of the mouth with a whortleberry decoction is frequently very beneficial. Very thick callous formations must be removed by the electrocautery, with a scalpel or by dry application of lactic acid, chromic acid or acid carbol-alcohol.

O. K.

Pathohistologic Studies of Paradentitis (Bohres and Hildegarde, Deutsche Zahnarztl. Wchnsch, 1932, pp. 687-702): The authors made an intensive histopathologic study of the mouth tissues in cases of paradentitis and came to the following conclusions: Small epithelial defects of the oral mucous membrane seem to be the cause of paradentitis. The reaction of the organism on the epithelial defects is various. It depends on the power of resistance of the organism. A lowered resistance of the tissue or of the organism results in the loosening of the teeth.

O. K.

MISCELLANY

BOOKS RECEIVED

Practical Pedodontia or Juvenile Operative Dentistry and Public Health Dentistry. By Floyde Eddy Hogeboom. (Third Edition.) Published by the C. V. Mosby Company, St. Louis. Price, $6.50.

CORRESPONDENCE

"Procain Toxicity"

To the Editor:

R. M. Waters has made an excellent contribution to our dental literature on procain usage in his article on "Procain Toxicity" which appeared in the December issue of The Journal. His summary on "combative treatment" should be placed on file in a readily available notebook in every dental office where procain is extensively used.

While I feel that thorough knowledge of the foregoing is necessary, I disapprove of placing too much stress on the possibility of severe reactions in ordinary dental usage of procain. It is quite probable that Dr. Waters (a physician) would find more evidence of severe reactions in his clinical observations than would the dentist. I am convinced that procain should be used freely in the normal operative pursuits of the general practitioner of dentistry.

If observations on procain usage in this section of New England are typical of all parts of the country, the general public is not being granted the blessings of procain in the degree to which it is entitled. There must be several reasons that it is not used more extensively in the thousand and one instances where its usage is indicated. Timidity probably is one cause. If you give a timid dentist a vivid imagination (and he generally does have one) and let him read Dr. Waters' word picture of what to do in case of a severe reaction, he probably will pat himself on the back for not using procain except when he is forced to.

In my office, more than 2,000 injections of procain a year have been made for the past three years without one severe reaction. Is that luck? It may be, but I think not. It is more apt to mean obeying the simple principles outlined by Dr. Waters in his article. Slow, deliberate injections are absolutely essential. Avoiding intravascular injection is equally important and not difficult to assure in most instances.

Dr. Waters comments on the use of a barbiturate (brief action) as a premedicament in using procain. This, too, is an important aid. We have been using routinely a 1½ grain capsule of sodium pentobarbital, administered one-half hour before the appointment, preferably in the office. When circumstances would not permit its use, we have had no hesitancy about proceeding without it, if there was no unfavorable physical history. But we always use a solution with a minimum epinephrin content. In some instances, anesthesia will cease before we have finished the cavity preparation or what not, but it is easy enough to repeat the injection. My patients want procain; they like it and soon will demand it.

R. Bullock Jones,
702 Main Street,
Willimantic, Conn.

RESOLUTIONS OF THE AMERICAN SOCIETY OF ORTHODONTISTS ON PUBLICITY

Whereas, the health articles printed in many newspapers and other widely circulated publications often relate to the subject of malocclusion of the teeth and associated deformities; and

Whereas, the advice given frequently is not in accord with the ideas and practices of orthodontists whose opinions are the result of many years of study, clinical experience and investigation; and

Whereas, it is impossible to make broad,

general statements of value on this subject, owing to the fact that there are no two cases alike and that many factors are involved in the analysis of each case; and

WHEREAS, the main objectives of the orthodontic specialty are the prevention of malocclusion and the application of corrective treatment of malocclusion at the time which is most favorable for obtaining normal development; and

WHEREAS, to follow incorrect advice may result in a postponement of necessary orthodontic treatment and thus be directly responsible for many cases of serious malocclusion and facial deformity which will result in irreparable damage to the patient as related to health and appearance throughout life; be it therefore

Resolved, that the American Society of Orthodontists condemns the publication of advice concerning orthodontic treatment, unless such information is authoritative and of genuine value to the laity and of particular value to the person seeking information; and be it further

Resolved, that the American Society of Orthodontists is ready and willing at all times to cooperate with publications in the matter of furnishing advice and information regarding orthodontic problems; and be it further

Resolved, that a committee of three be appointed by the president to be known as the Public Relations Committee, the duties of this committee to be:

1. To endeavor to prevent the publication of incorrect information concerning matters in the field of orthodontia;

2. To consult with editors of health columns and to cooperate with them in the preparation of material for publication that will be of genuine value to the readers in the matter of prevention and treatment of malocclusion of the teeth;

3. To disseminate useful orthodontic information by contact with the public through the press and the radio and by means of lectures before suitable groups; and be it further

Resolved, that copies of this resolution be sent to THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION and to the *Journal of the American Medical Association,* requesting its publication in these journals.

B. E. LISCHER
CHARLES R. BAKER
ALBERT H. KETCHAM
B. FRANK GRAY
FRANK A. DELABARRE

LETTER TO THE EXECUTIVE OFFICERS OF THE STATE DENTAL SOCIETIES AND OTHERS

With the repeal of the Eighteenth Amendment, it is assumed all of the states will, at an early date, enact legislation for the control of the liquor situation. Therefore, I call your attention to the advisability of your state society's, through its legislative committee, promptly making contact with the proper officials and committees of your legislatures to the end that the interests of the dentists are fully safeguarded.

For instance, I secured a copy of Senate Bill No. 1, pending before the General Assembly of Ohio, and found that some definite changes were necessary. The judiciary committee of the senate held a hearing on this bill December 11, and I joined two members of our state legislative committee in arguments to grant the same consideration for the dentists as provided for physicians, and am fairly confident that the committee will give favorable consideration to our recommendations. The original phraseology made no provisions for the dentists securing or prescribing spirituous liquors and only listed them with the veterinarians in the purchase of alcohol and required that such applications be supported by affidavits. In view of this situation, may I not suggest that prompt attention be given to this problem. (It is quite possible that the electorate of some communities may authorize local option.)

No doubt most of you have heard some discussion with reference to S. 1944, now pending in Congress. This bill was introduced by Senator Copeland of New York and is frequently designated as the Tugwell Bill. Its purpose is to repeal the Food and Drugs Act, which was passed in 1906. The new bill includes food, drugs and cosmetics and there is no question that there is urgent need for supplementary legislation including cosmetics. Therefore, these strengthening provisions should be approved and supported, as they are in harmony with the attitude of the dental profession in its efforts to better regulate and standardize dental proprietary products.

In 1925 the California State Dental Association passed a resolution requesting the American Dental Association to appoint a committee to develop a program which would tend to standardize dental proprietary products, as relates to both ingredients and their advertising claims, etc. The following committee was named: Harry E. Kelsey, M. D. Huff, L. L. Barber, Mark F. Finley and I, as

chairman. I spent considerable time in developing a cooperative program to be carried on in the laboratories of the American Medical Association, and our report submitted at the Philadelphia meeting, in 1926, is a matter of record and self-explanatory. This was the beginning of the activities of the Bureau of Chemistry, which was further supplemented by the Council on Dental Therapeutics. I am simply referring to this to show the necessity for supporting the constructive provisions contained in Senator Copeland's Bill. On the other hand, there is considerable opposition from manufacturers and others regarding its regulatory provisions, and it would seem that some of these are unreasonably drastic.

It is generally admitted by all that there is a need for strengthening the basic principles of the Food and Drugs Act, and it is hoped that the constructive provisions will be retained in order that the interests of the public shall be adequately protected and those that are detrimental and conflict with legitimate business activities shall be eliminated. This is a highly controversial question, and it is possible that a substitute bill will be finally agreed upon. Those desiring further information are referred to an editorial appearing on page 1882 of the December 9 issue of the *Journal of the American Medical Association.*

The General Assembly of Ohio is to meet early next month to enact some emergency tax legislation, and it is assumed that a number of other states will be required to take similar action. Therefore, we respectfully call your attention to the importance of protecting the interests of the profession from being unduly taxed, especially if a sales tax bill is under consideration. When such a proposal was before the Ohio Legislature, I appeared before a taxation committee and presented arguments against taxing health service, which resulted in the Committee adopting Item 10, under exemptions, as follows: "Sales by a physician or a dentist in conjunction with the rendition of a professional service." This sales tax bill was defeated, but it is likely to come up again during this Special Session. In the meantime, other states have adopted sales tax legislation, and only last week we received a telegraphic appeal from the Chairman of the Legislative Committee of the State of Washington for assistance in an effort to secure some relief from their state tax department. My suggestion is that it will be far better if you can secure an exemption when the legislation is being formed or pending, rather than after it has been enacted, and your attention is called to this tax question for that purpose.

The Dental Laboratory Code has been finally completed and I understand it will be reviewed this week by the laboratory group, as is the right of all proponents of a code. On the other hand, it is generally recognized that such a code will be promulgated by the NRA authorities and approved by the President, but it is our hope that the recommendations submitted by the representatives of the profession for its protection, as well as that of the public, will be incorporated, if and when a code is adopted.

I am sending this letter to the list of executive officers appearing in the December JOURNAL, as being the best method of promptly making contact with organized dentistry in the various states. I have a partial list of the chairmen of the legislative committees, but as this is more than a year old, it is possible, in the meantime, that some changes have been made. Further, our committee desires to again thank all who cooperated with our telegraphic request from Washington, under date of October 17.

HOMER C. BROWN, *Chairman,*
Committee on Legislation and Correlation,
American Dental Association.
609 Hartman Building,
Columbus, Ohio.

December 12, 1933.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, St. Paul, Minn., August 6-10.

American Dental Society of Europe, Holland, August.

American Public Health Association, Pasadena, Calif., September 3.

Chicago Dental Society Midwinter Clinic, February 26-March 1.

Five State Post Graduate Clinic, Washington, D. C., March 19-21.

International Congress of Radiology, Zurich, Switzerland, July 24-31.

Society for Advancement of General Anesthesia in Dentistry, New York City, third Monday in February, April, October and December.

Thomas P. Hinman Midwinter Clinic, Atlanta, Ga., March 12-13.

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

STATE SOCIETIES

February

Minnesota, at St. Paul (21-23) (Business meeting only)

April

Alabama, at Montgomery (23-25)
Connecticut, at New London (18-20)
Kentucky, at Louisville (9-11)
Michigan, at Grand Rapids (9-11)
Montana, at Missoula (12-14)
New Jersey, at Atlantic City (25-27)
Tennessee, at Chattanooga (26-28)
Texas, at Fort Worth (24-26)

May

Arkansas, at Little Rock (14-16)
Illinois, at Springfield (8-10)
Indiana, at Indianapolis (21-23)
Iowa, at Cedar Rapids (1-3)
Maryland, at Baltimore (7-9)
Massachusetts, at Boston (7-9)
Nebraska, at Lincoln (21-24)
New York, at Buffalo (9-12)
South Dakota, at Mitchell (14-15)
Vermont, at Burlington (16-18)
West Virginia, at Clarksburg (21-23)

June

Southern California, at Los Angeles (4-6)
Georgia, at Atlanta (11-13)
New Hampshire, at Lake Sunapee (27-28)
North Carolina, at Wrightsville Beach (18-20)
Washington, at Tacoma (14-16)

STATE BOARD OF DENTAL EXAMINERS

Delaware, at Wilmington, January 17-18. W. S. P. Coombs, Secretary, Middletown.

North Dakota, at Fargo, January 9-12, R. E. Percy, Secretary, Mandan.

South Dakota, at Sioux Falls, January 4-6. John J. Berry, Secretary, Deadwood.

AMERICAN DENTAL SOCIETY OF EUROPE

The next annual meeting of the American Dental Society of Europe will be held in Holland at the Hague at Whitsuntide, May 18-21.

EDWARD J. ORTION, *Secretary*
14 rue Christophe-Colomb
Paris, France

THOMAS P. HINMAN MIDWINTER CLINIC

The Thomas P. Hinman Midwinter Clinic will be held, March 12-13, at the Biltmore Hotel, Atlanta, Ga.

JOSEPH D. OSBORNE
Doctors' Bldg.
Atlanta, Ga.

AMERICAN PUBLIC HEALTH ASSOCIATION

The American Public Health Association will hold its sixty-third annual meeting in Pasadena, Calif., the week of September 3.

WILLIMINA RAYNE WALSH, *Secretary*
Committee on Meetings and Publications

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

OFFICERS AND TRUSTEES OF THE AMERICAN DENTAL ASSOCIATION

1933-1934

PRESIDENT

Arthur Cornelius Wherry.....910 Deseret Bank Bldg., Salt Lake City, Utah

PRESIDENT ELECT

Frank M. Casto.....1336 B. F. Keith Bldg., Cleveland, Ohio

VICE PRESIDENT

C. J. Caraballo.....713 Stovall Bldg., Tampa, Fla.
Albert Hallenberg.....Fargo, N. D.
H. E. Harvey.....Navy Department, Washington, D. C.

SECRETARY

Harry B. Pinney.....212 E. Superior St., Chicago, Ill.

TREASURER

R. H. Volland.....First Nat'l Bank Bldg., Iowa City, Iowa

BOARD OF TRUSTEES

Arthur Cornelius Wherry, President, Ex-Officio.....910 Deseret Bank Bldg., Salt Lake City, Utah
Frank M. Casto, President Elect, Ex-Officio.....1336 B. F. Keith Bldg., Cleveland, Ohio
Harry B. Pinney, Secretary, Ex-Officio.....212 E. Superior St., Chicago, Ill.
R. H. Volland, Treasurer, Ex-Officio....First Nat'l Bank Bldg., Iowa City, Iowa
Harvey J. Burkhart, '36.....Box 35, East Avenue P. O., Rochester, N. Y.
C. R. Lawrence, '36.....American Nat'l Bank Bldg., Enid, Okla.
Herbert C. Miller, '36.....E. 6th and Oregon Sts., Portland, Ore.
W. H. Robinson, '36.....American Bank Bldg., Oakland, Calif.
Harry Bear, '35.....410 Professional Bldg., Richmond, Va.
C. Willard Camalier, '35.....1726 Eye St., N. W., Washington, D. C.
Thomas L. Grisamore, '35.....29 E. Madison St., Chicago, Ill.
E. G. Meisel, '35.....121 University Place, Pittsburgh, Pa.
Marcus L. Ward, '35.....1308 Cambridge Road, Ann Arbor, Mich.
Albert W. Crosby, '34.....215 Whitney Ave., New Haven, Conn.
C. E. Rudolph, '34.....905 Metropolitan Bank Bldg., Minneapolis, Minn.
John F. Stephan, '34.....1034 Keith Bldg., Cleveland, Ohio
George B. Winter, '34.....Frisco Bldg., St. Louis, Mo.